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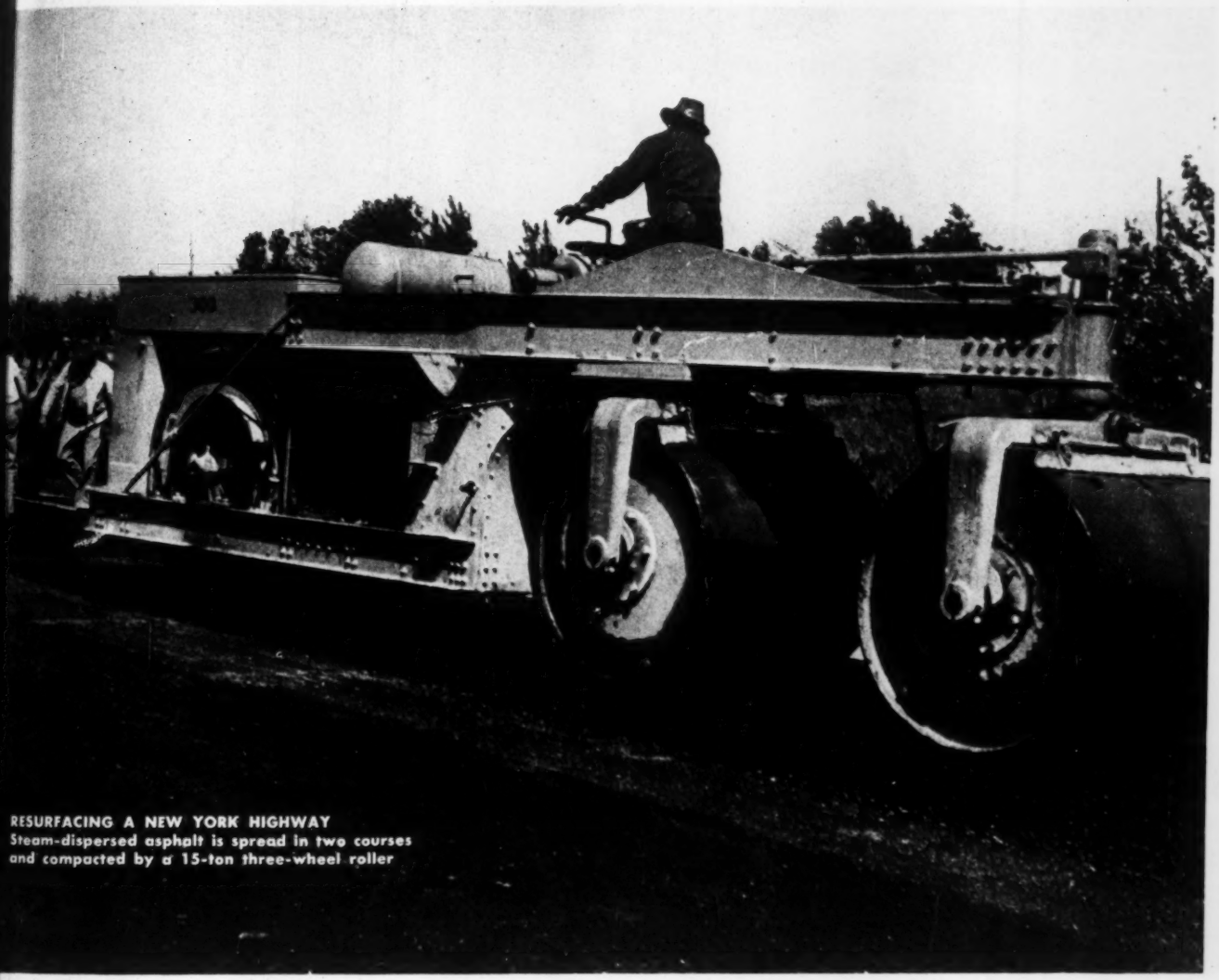
ENGINEERING NEWS-RECORD

AUGUST 22, 1946



RESURFACING A NEW YORK HIGHWAY
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Road Rebuilt with Steam-Dispersed Asphalt

War's Outstanding Floating Bridge

Precast Sectional Walls and Roof Provide for Reservoir Settlement

Radiant Heating for Aircraft Hangar

Building Airbase in the Azores

Davis Dam, a 3,900,000-cu. yd. Earth-and Rock Fill

HERE'S HOW ENGINEERS "Outlawed" PAVEMENT BREAKUPS

This state's highway subdrainage program was speeded and simplified by use of long lengths of sturdy, flexible perforated pipes. Begun in 1940, the work continues, and pays dividends in firm, smooth pavements that require little maintenance.

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ARMCO Perforated Pipe

ENGINEERING NEWS-RECORD

Volume 137 • Number 8 August 22, 1944

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The Editor, Engineering News-Record
330 West 42nd St., New York 18, N. Y.

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HOW TO PREVENT LADDER ACCIDENTS

The three principal causes of ladder accidents, in their order of importance, are: 1. Failure of the employee to work off or climb the ladder safely. 2. Failure to set up the ladder properly. 3. A break in the ladder itself. The only way to prevent these accidents is to furnish your foremen with the "know-how" to train your workers in safe practices on the job.

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Construction Trends

Construction's Competitive Position in the Labor Market

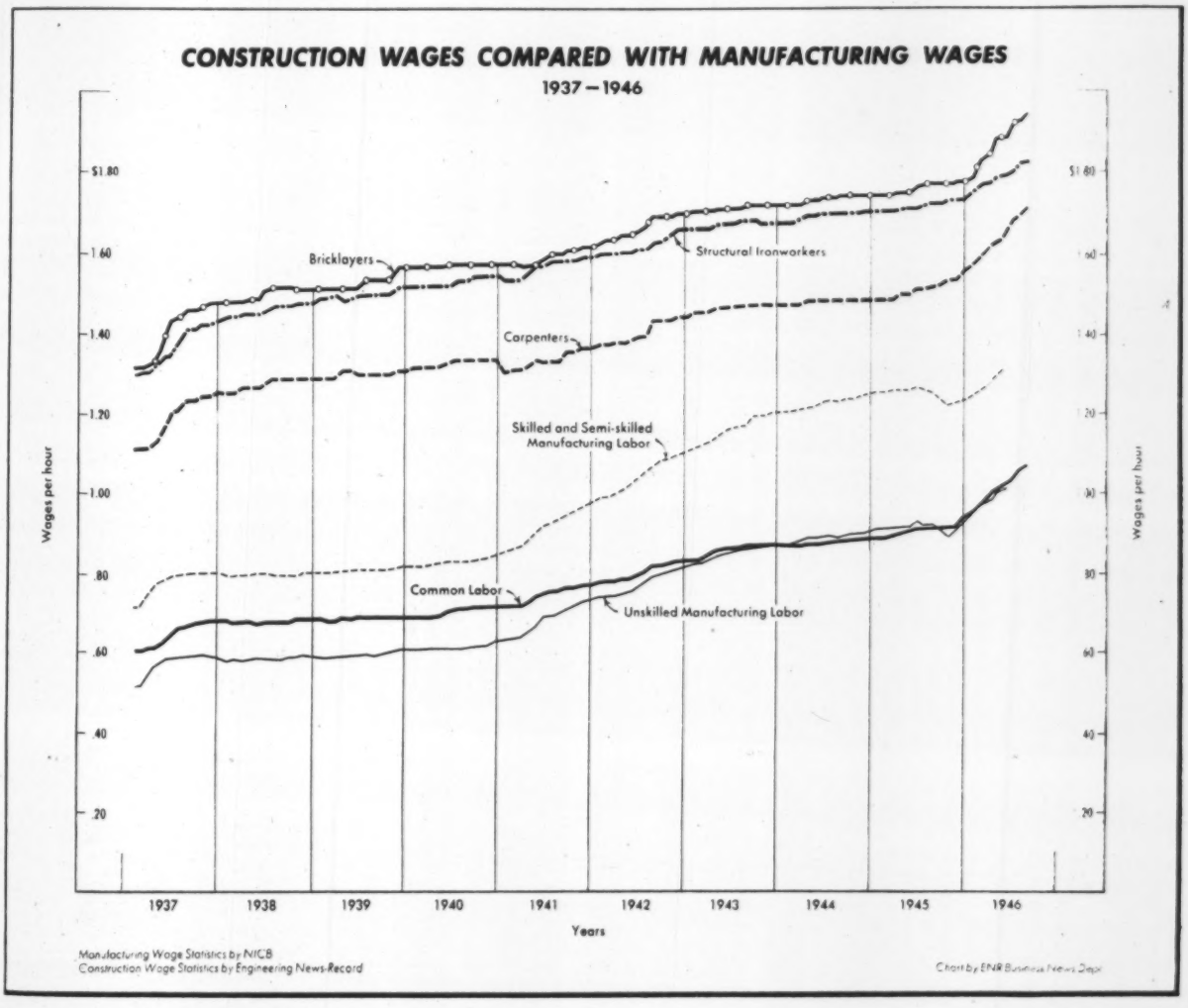
Construction is entering a period of labor shortages, as noted in this page two weeks ago. It is therefore in order to examine its competitive position in the current labor market.

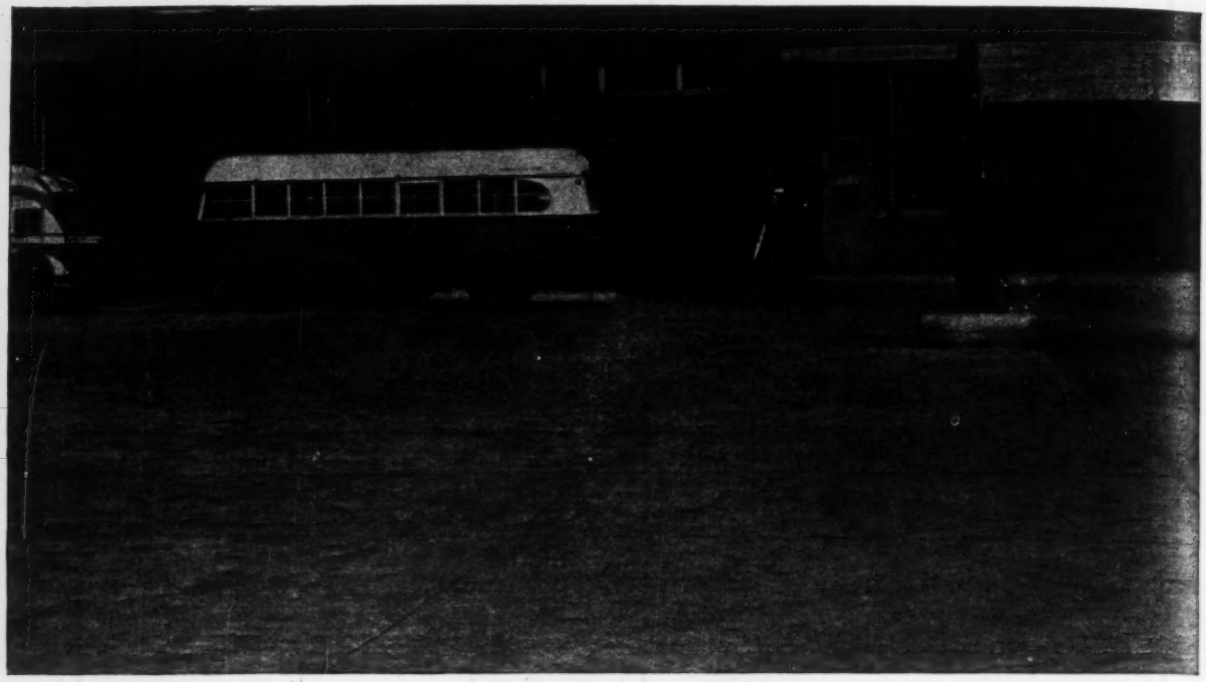
Skilled labor wage rates have gained 42.9% from January, 1937 to May, 1946, compared to a gain of 82.8% in the skilled and semi-skilled manufacturing trades. In this period, common labor rates increased only 68.8%, whereas unskilled manufacturing wage rates jumped 95.5%.

During the years 1941 through June, 1945, skilled construction wages increased only 13.1% lagging far behind skilled and semi-skilled manufacturing gains of 49.0%. Similarly, common construction labor wages rose 28.8%, while unskilled manufacturing wages jumped 47.8%.

Although the end of World War II brought about a temporary drop in manufacturing wages, they are again rising more rapidly than construction wages. During the first five months of this year, wage rates of bricklayers rose 6.2%, carpenters, 6.0%, structural ironworkers, 3.6% averaging 5.4% for skilled labor, while common labor rates increased 8.5%. Skilled and semi-skilled manufacturing wages rose 5.9% and unskilled manufacturing wages, 8.8%.

Historically, construction labor has been paid a higher hourly rate than manufacturing labor to compensate for weather shutdowns and other factors which cause construction employment to be irregular. During the war, common labor lost all of this "compensation" increment, and skilled construction trades lost much of theirs. Now, unless increases are permitted by the National Wage Stabilization Board, construction wages are frozen in this less favorable ratio. Accordingly, recruiting of construction labor is at a disadvantage in the current market.





Pavement made with Duraplastic air-entraining cement, Erie Coach Company Garage, Erie, Pa. Engineer, W. L. Lewis, Erie Coach Co.; Contractor, John Heubel Sr., Erie, Pa.

THREE TOUGH WINTERS AND STILL NO SCALING

in pavement made with Duraplastic

Three winters of freezing and thawing . . . plus drippings from trucks carrying calcium chloride and cinders . . . failed to scale this pavement made with Atlas Duraplastic air-entraining cement. Adjacent areas, made with regular cement, scaled considerably.

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News of the Week

ENGINEERING NEWS-RECORD • AUGUST 22, 1946 • VOLUME 137 • NUMBER 8

Wage raises in "no control" period may be law violations

Wage Adjustment Board rules construction wages raised during July 1-25 period must be rolled back to June 30 level or placed in escrow pending approval

Hundreds of employers in the building and construction industry who granted wage raises in the July 1-25 period, when wage controls were not effective, may find themselves in violation of the law unless the wage rates have been rolled back to the June 30 level, or the amount of increase put in escrow pending approval of the higher rates.

This situation prevails because the Wage Adjustment Board has received more than 700 applications for wage-increase approvals since it recovered direct controls over such adjustments on July 26. About 75 percent of them are cases which required a rollback of rates after Aug. 10 if approval had not been granted by that time.

WAB, in fact, has acted on very few of the applications because of its preoccupation with policy changes recently announced. Recognizing the employers' predicament, WAB has suggested that the equities of both employer and worker be preserved by an agreement to put the total wage increases in escrow, with WAB promising to make its approval retroactive if requested.

Penalties for non-compliance

Employers in this industry who continue after Aug. 10 to pay a wage rate which has not had WAB approval, or who have since instituted an unapproved rate, are subject to rulings disallowing the wages as costs for income tax purposes.

They may be protected, however, if the unapproved rates now fall in the category of pre-approved rates under the revised regulations.

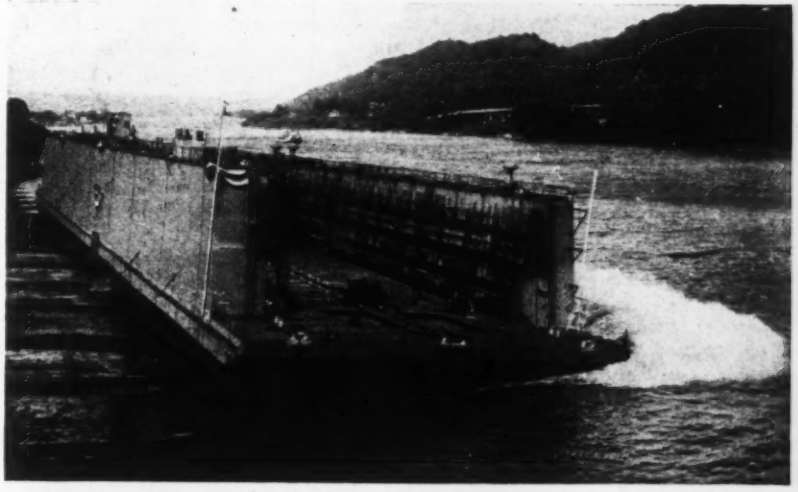
Contractors may now pay without the need for specific WAB approval only on these bases:

(1) Davis-Bacon Act rates on federal projects; (2) on non-federal work, the area rate announced by WAB; (3) the employer's established rate—which is his October 2, 1942, rate plus any approved increases; (4) travel time at the hourly rate, plus actual expenses, when the worker is required to report at one place and must travel to another site during the day; (5) increases to foremen to maintain past differentials; (6) travel expense, subsistence or other premium compensation if they were the employer's practice in 1942 or have since been approved by him or for the area in which he does business; (7) rates below 65 cents an hour may be raised to that figure without WAB approval.

All other rates, as well as any decrease of a rate, must have prior WAB approval. A contractor who takes advantage of these regulations to increase his rates may not revert back to his old rates without approval. For instance, if a non-union contractor raised his rates to the union scale—which normally is the area rate—he must continue to pay the higher wages unless he gets WAB's okay to cut back.

WAB has promised to publish in the *Federal Register* all the established rates by geographic areas, and any changes made from time to time. This is an improvement over past practice, when contractors often had to take the union's word for what the rates were.

These controls apply to wages or salaries of all on-site mechanics and laborers, including working foremen and apprentices, engaged in construction and building. Excluded are those whose work is non-manual or not performed primarily at the site, such as executive, technical, administrative and clerical employees. Rates of this latter group may be increased at will, but approval would be necessary before they could be used as a basis for price relief.



***Drydock sidelaunched into Ohio**—The 6,000 ton capacity ARD-33 (Auxiliary Repair Dock) built by Dravo Corp. at Neville Island for the Bureau of Yards and Docks was sidelaunched into the Ohio at Pittsburgh on Aug. 10. Much larger in size than its ship-shaped predecessors in the ARD class (ENR March 8, vol. p. 319 and March 22, 1945 vol. p. 385) it is 448 ft. long and 97 ft. wide with a fully open deck. Unusual in shipbuilding, the drydock was built in sloping position on the side ways to reduce launching stresses. Submergence tests will be made in a specially dredged area on the Ohio and then the $3,000,000 drydock will be towed 2,000 miles down the Ohio and Mississippi to the Gulf.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Water Supply—Extension of water service to new residential areas in *Toledo, Ohio*, and relief of low pressure in other sections will cost $1,109,582, the county sanitary engineering office reports. . . . *Daytona Beach, Fla.*, authorized extensions to the city water system, to include a new elevated tank, to cost $60,000. . . . A $1,000,000 system improvement program is under way at *East St. Louis, Ill.* . . . *Halifax, N. S.*, must spend about $650,000 to repair and replace its antiquated water system. . . . Seeking to increase the city's daily supply from 74mg. to 100 mg., *Dallas, Texas* city councilmen considered asking bids on a $1,900,000 program that would see construction of a new filter building, a 5mg. storage basin and pumps.

Sewerage—*Decatur, Ill.*, considered an engineer's report recommending a $450,000 program, to include interceptor lines and a new disposal plant. . . . The City of *Greensburgh, Penn.*, and two adjoining towns plan a disposal plant to cost $1,000,000. . . . *Tumwater, Wash.*, city councilmen rejected a proposal for a joint sewage disposal service with Olympia, despite an estimated saving of $70,000 in construction costs. . . . *Abington Township, Penn.*, has received state approval for a $2,162,000 sewer system.

Highways—The State of *Oregon* and *Polk and Marion counties* have agreed on the proposed construction of a $640,000 bridge over the Willamette River at *Independence, Ore.*, with each county to meet a quarter of the cost and the state, half. . . . *Wisconsin's* first major highway program—a 27-mile job on highway 30 between *Lake Mills* and *Madison*—is now under way. . . . Thirty-one blocks in downtown *Boise, Idaho*, will be widened to 51-ft., four-lane roadways, at a cost of $179,768. . . . The $360,000 *Livermore, Ky.*, toll bridge, which opened to traffic in 1940, will be freed of toll charges August 30, after the state highway commission reported that tolls, plus funds in the commission's hands, now cover the cost of construction.

Construction—The Tennessee Valley Authority will build a $3,000,000 phosphate fertilizer plant at *Mobile, Ala.* . . . Humboldt Plywood Corp. has started construction on a $1,000,000 plant near *Arcata, Calif.* . . . Home Acres Inc., of Camden, N. J., will build a $2,000,000 development at *Lawnside, N. J.* . . . A group of *Charlotte, N. C.* physicians will build a $700,000, 8-story, office building at *Charlotte, N. C.* . . . Collins Development Co., Chester, Pa., plans a $1,000,000 home Colony at *Wilmington, Del.* . . . R. F. Claborne, *Long Beach, Calif.*, will build a $1,912,000, 12-story apartment there. . . . Housing Enterprises Ltd., a Canadian non-profit organization, has completed plans for a $2,500,000, 400-unit apartment development to be known as "Benny Farms", at *Montreal*.

Miscellany—The *Washington State* Toll Bridge Authority is expected to call for bids within the next two months for the sale of about $8,000,000 of fiscal bonds to create funds for construction of a new *Tacoma Narrows* bridge. . . . Complaining that county officials took no action to make country roads passable, veterans of *Jackson County (Scottsboro) Ala.*, commandeered the equipment, set out to grade the dirt roads themselves. . . . *Boston, Mass.*, considered a plan to create a sightseeing center patterned after New York's famous Battery. . . . Because of a shortage of railroad cars, many *Pacific Northwest* lumber mills have stoped sawing logs until present stocks can be moved.

Nails, hardware, wiring put under priority rule

Nails, builders' hardware, electrical wiring devices, and a number of other metal building materials have been added to the list of items for which builders may obtain HH preference ratings to assist procurement for the Veterans' Housing, the Civilian Production Administration and the National Housing Agency announced in a joint statement last week.

In addition, the products were added to the list of materials for which HHH ratings may be granted to contractors working on veterans' temporary reuse housing projects.

The ratings for nails, however, have no effect on orders placed with producers, being effective only against distributors. CPA said that practically all production of nails is channelled through distributors.

Builders' hardware added to the priority list included the following types only: butts, hinges, hasps; door locks, lock trim; sash, screen and shelf hardware; night latches, dead locks; spring hinges; sash balances and sash pulleys.

Wiring devices added were: Sockets, lampholders and lamp receptacles; convenience receptacles; toggle switches; wall and face plates; outlet, switch and receptacle boxes; box connectors.

Approve $30 million power job for Pennsylvania

Pennsylvania's state water and power resources board on Aug. 15 gave final approval to an application of the Pennsylvania Power & Light Co. to construct a dam across the Susquehanna River at Shamokin Dam Borough, in Snyder and Northumberland counties.

Although details of the project were not immediately available, the application said that the project would cost "upwards of $30,000,000" and will feed an interconnected system serving a large and heavily-populated area between Washington and New York.

Calif. contractors fight black mart, 'racketeering'

With the declared purpose of controlling "racketeering in labor" and "black markets in materials," general contractors and subcontractors met at Bakersfield, Calif. last week to form the Kern County Contractors Association.

Fifty-four men participated in the meeting. The new group, organized to combat these conditions, absorbed the existing Bakersfield General Contractors Association.

Mr. Johnson said that the group hopes to control labor costs by insisting upon labor contracts that will run for the fiscal year, for example from June 1 to June 1, and eliminate contracts with employers that are effective one month or three months later than the signing.

He added that materials supply dealers were being asked to join the association to assist in eliminating the black market in local materials.

Camden, N. J., plans $7 million sewage work

The Camden, N. J. City Commission recently approved a $7,000,000 sewage improvement and expansion program, and said the project needs only the approval of the state Department of Health before construction is started.

Principal item in the program will be construction of a new disposal plant along the Delaware River near Jackson St. at a cost estimated at $2,000,000.

The plan also calls for the overhaul of an existing plant at 32d St. and Farragut Ave. When the program is complete, city officials said the city will have eliminated the pumping of untreated sewage into the Cooper and Delaware Rivers.

Status of employed Canadian engineers clarified by national labor board

Segregation of engineering employees for collective bargaining purposes approved by the Wartime Labor Relations Board

Grouping of various grades of engineering employees in collective-bargaining units of their own choosing was approved by the Wartime Labor Relations Board of Canada in two recent decisions, thus bringing to a close a long period of uncertainty as to the exact status of engineers under the dominion and provincial labor laws. Excluded from the bargaining group authorized by the board are all engineers actually engaged in a confidential or supervisory capacity.

One decision relates to engineers of the Toronto Hydro-Electric System and the other to engineers in the employ of the Bell Telephone Co. of Canada.

Shortly after the passage of an act setting up the Wartime Labor Relations Board, engineers in Canada sought and were granted temporary exemption from the provisions of that act in order to give them time to recommend what status they would like to have under the act. (*ENR*, May 18, 1944, p. 724). To give them the desired exemption, the board ruled that it would consider all engineers as "employed in a confidential capacity," specifically exempted from the provisions of the act setting up the board.

Subsequently, representatives of the several engineering societies recommended to the Minister of Labor that a separate order-in-council be issued covering collective bargaining for engineers. This recommendation, however, was disapproved, but the labor board advised the engineers that it would deal with professional groups separately in matters relating to employment conditions.

Employee organizations created

Meanwhile, the Association of Professional Engineers of the Province of Ontario and the corresponding association in Quebec had sponsored the organization of federations of engineering employees from among the employee members of their organizations collective-bargaining units within engineering organizations in those provinces.

One such unit, known as the Toronto Hydro-Electric System of Employee-Professional Engineers and Assistants, was set up by the employees of the Toronto Hydro System and it appealed to the Ontario Labor Relations Board for certification as the collective-bargaining agent for those employees, only to have the Ontario Board turn the application down because of the national board's original ruling that it would consider all engineers exempt from the labor laws.

This decision has now been set aside by the national board, which has certified the Toronto Hydro-electric System of Employee-Professional Engineers and Assistants as the bargaining group for engineers of the Toronto Hydro System, with the understanding that the units include no persons employed in a confidential capacity or having authority to employ or discharge. In so doing, the board said, "This board is prepared in proper cases to certify duly elected or appointed bargaining representatives of bargaining units constituted of employees employed in professional engineering or employed in training for professional engineering and to deal with the issue of whether a professional employee is employed in a confidential capacity on the facts of the particular case."

Bell Telephone decision

Further clarification of the Wartime Labor Relations Board's attitude toward engineers was provided in the board's decision ordering an election among employees of the engineering department of the eastern area of the Bell Telephone Co. of Canada and in the division plant engineering groups of the eastern area plant department of the same company in an appeal by Unit No. 3 of the Quebec Federation of Professional Employees.

This application was opposed by the Bell Telephone Co. on the ground that the engineering employees were exempt from the labor laws under the same ruling that had resulted in the Ontario Board's denial of the Toronto hydro employees appeal. The company also sought to establish that the group of professional engineers classified in the company's organization charts under the title of "engineering assistants" were employed as technicians rather than as professional engineers, and pointed out that there were a considerable number of non-professionally qualified employees doing the same work. The company contended that technicians should be included in the unit, but if this were not done then that all professional engineers classed as engineering assistants should be excluded.

As membership in the federation was limited to graduate or registered engineers, it was not then prepared to represent the subprofessional men. It asked for time to consider the matter and subsequently amended its constitution to include these men, making its application cover an engineering craft unit.

On the question of who should be included the board said, "In our opinion, like considerations apply in general in determining an appropriate bargaining unit comprising or including occupational classifications requiring professional skills as apply in determining an appropriate craft unit comprising or including occupational classifications requiring a particular artisan skill. An appropriate unit should include the occupational classifications engaged in common employment in the same line of skilled work and in which there is by reason of training or experience and established practice the normal opportunity for promotion from the lowest to the highest occupational classifications."

In giving specific application to this general principle, the board stated that in this present instance the bargaining unit should include employees performing the duties of engineering assistants, technical assistants, student engineer, assistant engineer, and engineer below the rank of division plant engineer employed in the engineering department and in the division plant engineering group; but excluding therefrom those employees exercising supervisory and confidential functions. Into this latter class the board put about 40 engineering titles, beginning with the engineering vice president, chief engineer, architect, and others.

Union wages enforced on Penna. highways

The Pennsylvania Federation of Labor recently signed an agreement with the State Department of Highways and the Associated Pennsylvania Constructors to guarantee union wages on state highway construction projects.

Under the agreement, which has still to receive approval by the National Wage Stabilization Board, the department will award contracts only to firms that pay the scale prevailing in the district where the projects are located. The agreement divides the state into four districts, with only small differences in pay schedules.

Wage scales, covering practically all road construction workers, will agree with scales set by the AFL carpenters, operating engineers, hodcarriers, laborers and teamsters.

Ray F. Smock, secretary of the highway commission, emphasized that the agreement does not apply to the state's per diem road workers, and that the contractors need not sign collective bargaining compacts with the unions. Individual workers are not compelled to join unions under the agreement.

Place 80 WAA construction materials under priority control to aid housing

New regulations issued by housing agency make war assets stock more readily available to home builders

Housing Expediter Wilson W. Wyatt Aug. 17 issued two regulations (Housing Expediter Priorities Regulations 1 and 2) to speed the channeling of surplus building and utilities materials and equipment held by the War Assets Administration into the Veterans Emergency Housing program and the Veterans Administration construction program.

The action is designed to make available from surplus stocks of the WAA a number of building materials not heretofore available to housing and veterans' hospitals.

HEPR 1—which replaces Direction 7 to the Civilian Production Administration's Priorities Regulation 13—grants the emergency housing program and the Veterans Administration's construction program preferential consideration in the acquisition of more than 80 types of surplus building materials (CPA Direction 7, which is now revoked, covered only 30 materials).

HEPR 2 makes similar provision for the disposition of surplus materials and equipment for services and utilities (water, power, gas, or sewerage).

Under both regulations, surplus materials, supplies, and equipment on the lists must be made available during a 15-day period for transfer to the Veterans Administration for hospitals and other facilities (and utilities for such construction), and the Federal Public Housing Authority for providing temporary re-use housing for veterans and their families.

The new Regulation 1 will give private builders access to surplus materials immediately after the Veterans Administration and the FPHA, instead of requiring them to wait until various other claimants are satisfied. Holders of HH priorities are assured that materials will be offered to them exclusively after WAA has once made its public announcement of sale.

This will be accomplished by offering surplus building materials on the HEPR 1 list, not acquired by VA and FPHA, for sale to persons who certify that the materials will be used exclusively in building dwellings under the housing program, and to regularly established sellers of building materials who certify that the materials will be sold by them only to such persons. HEPR 2 contains a similar provision which applies to states, municipalities, publicly or privately-owned utilities, or contractors, who must certify that the utilities materials and equipment on the HEPR 2 list will be used to service housing accommodations under VEHP or to meet a public emergency.

Persons entitled to purchase WAA surplus materials and equipment during this "exclusive offering period" will be notified of the date and place of sale through advertisements to be run by WAA regional offices 10 days in advance of such sale. Materials made available from the dismantling of surplus military installations will also be disposed of under the new priority regulations.

A list of the 80 materials placed under control by this order will appear in next week's issue.

KNOXVILLE, TENN., BARS PREFAB CONSTRUCTION

Five-room prefabricated houses do not meet the building code of Knoxville, Tenn., and cannot be erected in that city, according to Ben England, city building inspector. The city code calls for brick or frame walls of a greater thickness than that provided by the prefabricated structures.

However, W. C. McCammon, Jr., Knox county planning engineer, said that prefabricated houses can be erected in the county, provided "set back" and side yard requirements in the zoned areas are met. There are no electrical or plumbing codes in effect outside Knoxville.

Mass. seeks substitutes to speed vets' housing

Substitute building materials to speed up the veterans' housing program in Massachusetts will be sought by a special committee appointed recently by Lewis H. Weinstein, chairman of the state's emergency housing commission.

Concerned over the failure of builders to find regular construction materials in sufficient volume to push the housing program, Mr. Weinstein said he expected the committee to produce the answer in substitutes. Committee members are: Joseph Hadnut, dean of the graduate school of design of Harvard University, and chairman of the Housing Association of Metropolitan Boston; William W. Rausch, president of Anchorage Homes, Inc., and Anthony Taurasi, president of of the Home Builders Association of Greater Boston.

Record-breaking rains flood St. Louis area

More than 2,000 families in the St. Louis, Mo., area were homeless last week following long continued rains which totalled 13.20 inches in 48 hours, a greater rainfall than had ever occurred in that district in such a period for the 109 years that records have been kept.

The flash floods caused a damage of at least $1,000,000 in the area. About 500 families were evacuated in the Belleville, Ill. section, and more than 1,000 from the Collinsville-East St. Louis area. An additional 500 were homeless in other east side areas and about 60 families in St. Louis County. Buses and street cars on several Public Service lines were stalled. Telephone service was interrupted. Five major railways were unable to use their own tracks for service to and from St. Louis. Operations at Lambert-St. Louis Municipal Airport were suspended at 2 A.M. Aug. 16. The Mississippi River rose 12.2 ft. The Missouri and St. Charles Rivers rose 8.2 ft. above stage of Aug. 15.

Jefferson City, Mo. also suffered the worst flash flood in its history. Damage of upwards of $100,000 was reported.

To build new highway bridge at St. Louis

The U. S. Corps of Engineers at St. Louis recently awarded a general contract for the construction of a new highway bridge over Chain of Rocks canal, about 3 miles from Mitchell, Ill. for a low bid of $1,585,000.

The new bridge will be part of the War Department's program for the changing of the channel of the Mississippi River near Chain of Rocks, just south of its junction with the Missouri River, to eliminate a hazardous stretch. The new bridge would serve vehicular traffic only, being a relocation of U. S. Highway 66.

The contract was awarded to the Bushman Construction Co. of St. Joseph, Mo.

Plan new toll bridge

Meanwhile the city of East St. Louis, Ill., has been authorized under a bill signed by President Truman Aug. 8 to construct, maintain and operate a toll bridge across the Mississippi River.

Plans for a $4,500,000 reinforced concrete and steel structure have been prepared by Prof. George A. Maney of Northwestern University, Evanston, Ill. The bridge would extend from a point near Third St. and St. Louis Ave. in East St. Louis to a point between Cole Ave. and Delmar Boulevard near Third St. in St. Louis, Mo.

Midwest road men discuss costs, plans

At a two-day meeting of highway user organizations from twelve midwestern states, held in Chicago Aug. 9-10, attention was focused on highway construction from the standpoint of financing, costs of construction and safety.

Inflationary cost of construction and misuse of revenues derived from motor vehicle taxes are retarding the national highway construction program, said Arthur C. Butler, director, National Highway Users Conference. "This slowdown period," he said, "affords an unprecedented opportunity to make certain that only the necessary roads are constructed and that expansion of the highway program takes place on a long-range basis in line with the highway users' ability to pay for the roads."

Four-point program

A positive program of highway planning for 10 to 15 years ahead is needed in every state to avoid wasteful expenditures on unnecessary projects, declared Mr. Butler.

Such a program should be based on four cardinal points: (1) highway planning to meet future needs; (2) sound financing of both highway construction and maintenance; (3) safely engineered and operated vehicles, and (4) uniform laws and regulations designed to aid the function of motor transport.

Increased highway safety is tremendously important, he added, and particular emphasis must be placed on adequate and uniform laws and their rigid enforcement.

Dawes E. Brisbane, research council, National Highway Users Conference, also urged caution in highway planning. In the face of present day rising costs, said he, state highway departments and the highway users themselves should be certain that each project is necessary before it is approved. This is particularly essential when a state's roadbuilding program exceeds its anticipated revenues, and when such revenues surely will increase materially during the next two years with the resumption of full automobile production, he said.

Resolutions adopted by the conference urged (1) all motor vehicle use taxes be spent solely for highway purposes; (2) there be no increase in taxation on either gasoline or other automotive taxes for financing the highway program; (3) state legislatures adopt laws permitting the operation of intercity buses 102 inches in width; and (4) states should eliminate highway barriers by entering into reciprocal agreements concerning motor vehicle use tax and regulations.

Congress sets up new road committees

The legislative reorganization act of 1946, signed by President Truman on Aug. 2, completely revamps congressional procedures, and abolishes both the Senate and House Road Committees, setting up a Committee on Public Works in both branches.

The law in general reduces the number of standing committees in the Senate from 34 to 15, and in the House from 48 to 19.

According to the American Road Builders Association, the Senate Committee on Public Works will consist of 13 senators and will have jurisdiction over all proposed legislation relating to construction and maintenance of roads and post roads and the following:

(1) Flood control and improvement of rivers and harbors; (2) public works for the benefit of navigation, and bridges and dams (other than international bridges and dams); (3) water power; (4) oil and other pollution of navigable waters; (5) public buildings and occupied or improved grounds of the United States generally; (6) measures relating to the purchase of sites and construction of post offices, custom houses, federal court houses and government buildings within the District of Columbia; (7) measures relating to the Capitol Building and Senate and House office buildings; (8) measures relating to the construction or reconstruction, maintenance and care of the buildings and grounds of the Botanic Gardens, the Library of Congress and the Smithsonion Institution; (9) public reservations and parks within the District of Columbia.

The Committee on Public Works in the House will consist of 27 members having jurisdiction over the identical matters specified for the Senate Committee, with the exception of the item pertaining to roads, whith, ARBA said, reads as follows: "Measures relating to the construction or maintenance of roads and post roads, other than appropriations therefor, but it shall not be in order for any bill providing general legislation in relation to roads to contain any provision for any specific road, nor for any bill in relation to a specific road to embrace a provision in relation to any other specific road."

States accept PRA national road network

Thirty-nine states approve plans for 37,170 miles of integrated roads

Thirty-nine states and the District of Columbia have accepted without reservation the integration by the Public Roads Administration of routes proposed by the states to form the proposed national interstate highway system, according to an announcement by the Federal Works Agency.

Commissioner Thomas H. MacDonald of the Public Roads Administration said that of the nine remaining states, four desire alteration of the integrated system proposed, and five states have not as yet responded to the PRA's recommendations.

Development of a 40,000-mile interstate highway system was authorized by the Federal-Aid Highway Act of 1944, and the states were asked last year to recommend routes for inclusion in the system. Total length of the routes selected by state highway departments was 45,074 miles, which includes some duplicate mileage and more than 2,000 miles of circumferential and distributing routes in urban areas.

After receiving the initial route selections recommended by the states, PRA offered a tentative integration of the system. Under this plan, all circumferential and distributing routes in urban areas were omitted. The main routes between and across cities which are included in the interstate system as recommended include 37,170 miles. This leaves a balance of 2,830 miles within the 40,000-mile statutory limitation—considered a sufficient reserve for the later selection of circumferential and distribution routes.

Development of the system eventually will provide two-lane, four-lane and in some instances six-lane highways for fast moving traffic between all cities having a population of 100,000 or more, and a majority of the cities of 10,000 to 100,000 population.

Plan $25 million tunnel under Delaware River

The Delaware County, Pa. Authority at its headquarters at Chester, Pa. said last week that plans were complete for a $25,000,000 vehicular tunnel under the Delaware River beween Tinicum Township, Pa. and Gloucester County, N. J.

The authority said that it had tentatively set the spring of 1947 as a date for taking bids, pending final arrangement of financing.

Verus T. Ritter of Philadelphia is architect for the authority.

ENGINEERING SCHOOL NEWS

Cornell to open five-year engineering physics course—Georgia Tech shuts down enrollment for coming session—Other news notes

One of the nation's first schools of engineering physics with a five-year curriculum will be opened at Cornell University, Ithaca, N. Y., in September to train students in a combination of engineering principles, applied physics and mathematics for careers in research and development.

To be known as the Department of Engineering Physics, the new division is designed to help meet industry's demand for men with broad training in these fields to engage in the increasingly important work of industrial research and development.

The new department will be administered through the College of Engineering, but will be operated through the cooperation of several colleges at the university—chiefly the Engineering and Arts and Sciences. The degree granted, Bachelor of Engineering Physics, will be awarded upon completion of the five-year curriculum, and graduate work will be offered through the graduate school of the university.

Authorities at Georgia Institute of Technology, at Atlanta, Ga., have halted the taking of applications for entrance for the quarter beginning in September, closing the institution's doors to about 3,000 hopeful, but overflow, students.

Despite the order to receive no more applications, Lloyd Chapin, registrar, said that Georgia Tech would reach a total of 4,361 regular students this year, against a prewar quota of 2,600 students. Reason for the action was given as Tech's antiquated and in many cases inadequate class rooms.

While the college has been under a strain to house its students and to provide accommodations for married veterans, Tech has managed in general to provide roofs for its personnel in the face of the most acute housing shortage Atlanta has ever suffered. According to Mr. Chapin, the school received applications for the fall quarter of 7,546 regular students, 760 division of Emergency Training refresher course students, and 300 have asked for evening courses.

The work of moving Harvard University's 35-ton automatic calculator to its new home near Oxford and Jarvis Streets in Cambridge, Mass., is now well under way.

The highly intricate Harvard calculator solves complex mathematical problems enabling researchers to get quicker answers to many technical questions. It has been located in the basement of the Crufts Laboratory.

In order to move the machine, an oversize elevator was constructed to handle the disassembled parts.

Randolph P. Hoelscher, professor of general engineering drawing at the University of Illinois, has been appointed associate dean of the college of engineering, in charge of courses offered in the University of Illinois off-campus school on Navy Pier, Chicago.

Charles A. Ellis, professor of structural engineering at Purdue University for 12 years, will retire on Sept. 1. He will be replaced by Prof. Lawrence T. Wyly, associate professor of structural engineering at Northwestern Technological Institute of Northwestern University. Mr. Ellis served as designing engineer on the Golden Gate bridge at San Francisco.

George W. Reid, formerly with the U. S. Public Health Service and before that with the Illinois State Public Health Department, has joined the civil engineering department of Georgia Tech, as head of the new sanitary engineering option course which leads to a B.S. and to an M. S. in sanitary engineering.

Let contract for Bull Shoals construction

Actual construction of Bull Shoals dam, a $47,000,000 Army Engineer project in north central Arkansas, is scheduled to start early next month, following the recent award of a contract for construction of the main dam.

Col. Gerald Galloway, district engineer at Little Rock, Ark., said that the contract was awarded to the White River Constructors, of Houston, Tex., a seven-firm combine—for its low bid of $24,263,935.

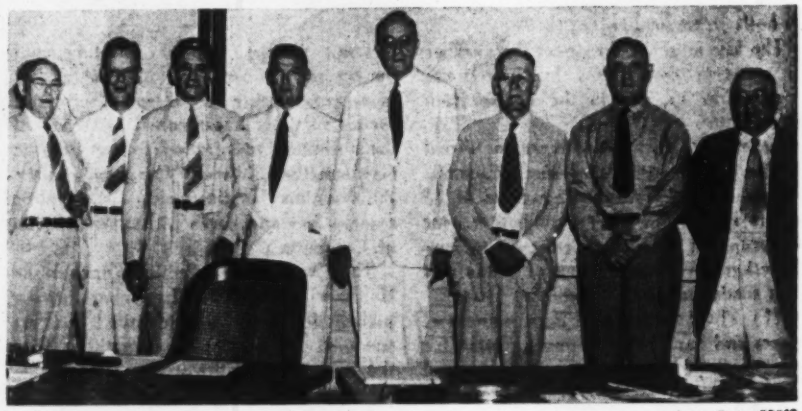
Bull Shoals dam will be the nation's fifth largest dam and reservoir. It will be an important step toward the control of the unpredictable White River which has flooded regularly since 1927. The construction job is expected to take about 39 months.

Preliminary work near ready

Preliminary on and off-site work, including construction of an access railroad and road and building of necessary office facilities, is nearing completion now.

Initial power installation planned is three 42,000 kw. units, with a total of 126,000 kw. capacity; ultimate installation will include eight such units with 336,000 kw. of capacity. The dam will be 263 ft. high and length at crest will be 2394 ft.

The White River Constructors is a combination of the firms of Brown & Root, Inc., Martin Wunderlich Co., Peter Kiewit Sons Co., Winston Bros. Co. David A. Gordon, Johnson Construction Co. and Condon-Cunningham Co. The bid price excludes the cost of cement.



U. S. Army Photo

***Inspect Panama Canal**—Members of the Board of Consultants for the Panama Canal pose for photographers at start of their first formal session recently held at Balboa Heights (ENR Aug. 8, vol. p. 205). Left to right are Joel D. Austin, Hibbert M. Hill, Brig. Gen. Hans Kramer, Col. James A. Stratton, supervising engineer of the special engineering division, Canal Zone Governor J. C. Mehaffey, W. H. McAlpine, Admiral Ben Moreell and Boris A. Bakhmeteff. The group urged speedy expansion of canal facilities.*

RANDOM LINES *from an editor's notebook . . .*

In which a member of the Pacific Coast staff reports on a conducted tour of the Columbia Basin Project in the Pacific Northwest

Construction of the Columbia Basin irrigation project, (*ENR* May 16, vol. p. 780), is ready to shift into high gear. This is clearly evident on inspection of the site of the Bureau of Reclamation's 1,000,000-acre land development scheme which will include more than 4,000 miles of irrigation canals and require twice as many man-hours of construction as Grand Coulee Dam—largest concrete dam in the world.

Our guide and chauffeur on the 330-mile trip was H. A. Parker, irrigation engineer, who now has headquarters at Ephrata, Wash. A veteran of 37 years with the bureau, Mr. Parker has been on this project since 1939 and is now in charge of its irrigation features—on many miles of canals, tunnels and siphons; on all of the laterals; on two dams; on laying out farm sites.

The farms to benefit from the work will vary in size up to the 160-acre maximum to take advantage of contours and soil types. The million irrigable acres contain 33 percent of Class 1 farmland, 40 percent Class 2, and 27 percent of Class 3.

Changes in plan

A view of the Potholes Dam site demonstrated the fact that engineering location cannot be made solely in the office. The original layout called for a straight crest line of some 15,000 ft. with an earthfill volume of 12,000,000 cu. yd. However, after consideration of foundation tests and other local conditions, a longer, meandering crest was adopted which, by following ridges, resulted in less total yardage, reduced total haul and provided a site with flatter slopes.

Soap Lake Siphon is another example of changes of the original layout after field investigations. Original plans specified a siphon on a rockfill across the lake. However, the lake mud proved to be too soft to support the weight. The shortest alternate route was around the lower end of the lake; but, by routing the siphon around the upper end, a saving was effected as a greater length of open channel could be used, thus shortening the siphon length.

Only water needed

Midway on our trip we drove to the top of a pass over the Saddle Mountains so we could view much of the project's area. In only a few miles we climbed 1,500 ft. to where, to the north, could be seen a checkerboard of sage brush, dry wheat farms, and areas that had been cleared by hopeful farmers in the past, only to meet with failure because of lack of water.

To the south we could see in the distance parts of the Hanford atomic bomb plant. About 100,000 acres of the project's land lie within the zone labeled by the Army as potentially dengerous and is restricted against travel. However, this area is near the southern end of the project and it will be several years before water will get this far.

A spectacular construction undertaking is the proposed Bacon siphon and tunnel, and it will tax the ingenuity of the contractor, T. E. Connelly, Inc. Located at a narrow point in the coulee, the canal comes out of a heavy rock cut, goes across the coulee through a 1,000-ft. siphon and thence into a 10,000-ft. tunnel which has its upstream portal on the face of a sheer precipice. The present contract covers construction of a 23-ft. diameter siphon and 23-ft. diameter tunnel. At a later date a parallel siphon and tunnel will be constructed.

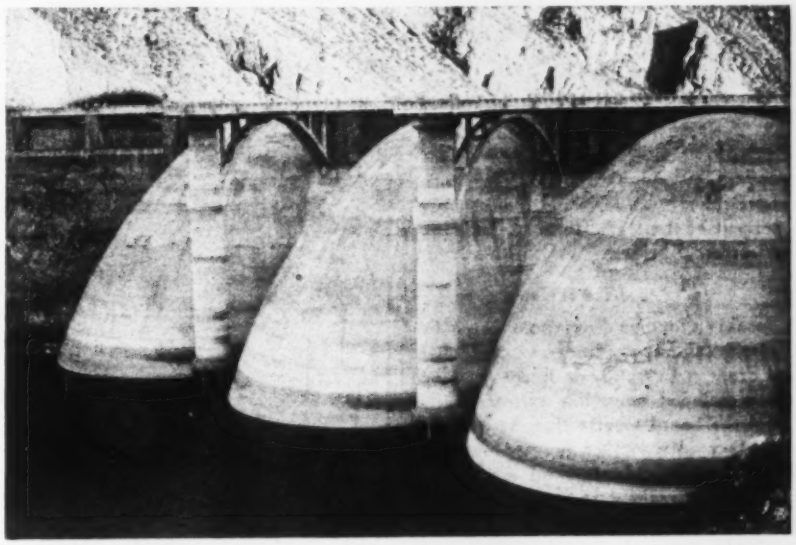
Although much construction is soon to be started, the only contractor at work was the Morrison-Knudsen Co., which has a contract for grading a portion of the Main Canal. Rolled earth canal embankments are being made by carrying-scrapers and sheepsfoot rollers, and the 50-ft. wide canal is being excavated by a walking dragline.

The day-long trip concluded at general headquarters at Grand Coulee Dam where the boss of the entire project, Frank A. Banks, and his assistant, R. B. Williams, hold forth.

While being driven across the dam by S. E. Hutton, of the bureau's staff, we were able to look down upon a waterfall twice the height of Niagara, flowing over the dam at the rate of 240,000 sec.-ft. (maximum flow this year was 395,000 sec.-ft.). Work is under way by bureau forces on the Grand Coulee Dam pumping plant, to be the world's largest, and the powerhouses are being prepared for generators to supply power for the pumping plant. Shasta Dam generators installed at Coulee as an emergency wartime measure are being removed to make room for the large 108,000-kva. Coulee generators.

The "engineers city" at Coulee Dam looks like an attractive suburban town with its green lawns, trim houses, and shade trees—a dramatic contrast with the square miles of dry wheat farms and sage brush to the south. It is thrilling to realize that one day part of the flow over the dam will be diverted to make the bleak 1,000,000-acre basin area as attractive as the bureau's townsite and as productive as the Iowa cornbelt or California's Central Valley.—*L. L. W.*

[This was written before the President ordered a drastic cut in all federal construction operations.—EDITOR]



***Drought**—Extreme drought in Arizona has drained water in the San Carlos Reservoir on the Gila River to a point below the penstocks of Coolidge Dam, completely shutting down the power plant. The reservoir water dropped below the sill of the outlet gate June 24, and since then the pool has been falling slowly through evaporation and other losses. In mid-July, available storage in the lake—which has a normal capacity of 1,285,000-ac. ft.—was minus 344.*

New San Francisco Bay crossing urged in discussion at Army-Navy hearings

Construction of second Bay crossing unanimously supported, Reber Plan challenged, numerous other Bay crossing plans suggested at four-day session in San Francisco

The need for a second San Francisco-Oakland Bay crossing was strongly emphasized by engineers, politicians, and just plain citizens at hearings held by a joint Army-Navy board which began Aug. 12 (*ENR* July 4 vol. p. 8). Questions on which there was a divergence of opinion and which remain to be settled were (1) type of crossing to be made (i.e., high level bridge, low level bridge, subaqueous tube, or fill causeway) and (2) the need for a rail crossing.

Speaking for the California Department of Public Works, F. W. Panhorst, bridge engineer, told the board that at the request of the California Toll Bridge Authority his organization already had studies under way considering the location of a new crossing. Although these studies are not complete—lacking primarily adequate foundation investigations—preliminary cost estimates for ten crossings were presented (see map). Eight of the crossings under study are high level bridges (two decks with five 12-ft. traffic lanes each), one is a tube (four lanes), and one a combined low level highway and railway bridge (six highway lanes on one deck and four railway tracks on another). Mr. Panhorst pointed out that a low level bridge is the only feasible bridge crossing for railroads because of grade requirements. Others said that because of the U. S. Navy drydocks at Hunters Point the only possible low level bridge location is near the southern boundary of San Francisco. This location, Panhorst said, would divert only 5 percent of the traffic from the existing overburdened bridge.

San Francisco's views

Speaking for San Francisco, Ralph G. Wadsworth, city engineer, stated that San Francisco strongly desired a crossing which included main line railroads and urged the board to give this matter consideration. He further pointed out that San Francisco did not want a crossing entering the main downtown and industrial area (north of Potrero St.-Alameda Bridge on map) because it would increase traffic congestion.

Appearing in behalf of the Reber Plan were John Reber, (*ENR* July 11, vol. p. 56) and L. H. Nishkian, consulting engineer. Mr. Nishkian estimated the total cost of the Reber Plan to be some $200,000,000. He also presented his own plan for a causeway crossing of the bay with tubes under a ship channel near the Oakland side and estimated its cost as less than $100,000,000 ($69,150,000 for the fill and tubes and $30,000,000 for approaches). Such a causeway would be a 2,000-ft. wide fill and would include four railroad tracks, 24 vehicle lanes and industrial acreage.

Reber plan opposed

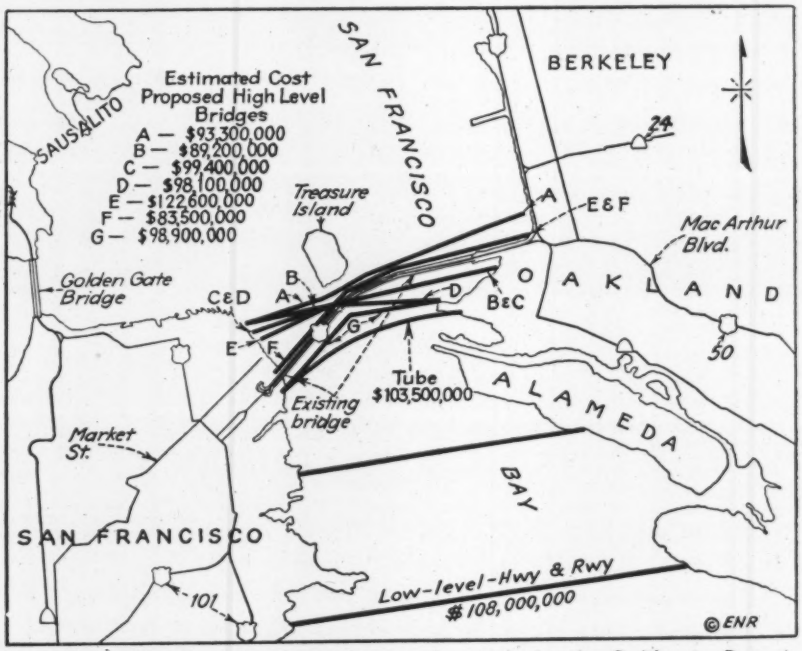
Speaking for Alameda County, Glenn B. Woodruff, San Francisco consulting engineer and one of the designers of the existing Bay bridge, estimated the cost of the Reber Plan to be some $2,500,000,000. He estimated the south fill and tubes to cost $185,000,000 compared with Nishkian's $69,150,000 estimate.

Mr. Woodruff concluded that the Reber Plan would not result in a desirable development of San Francisco Bay because (1) it would destroy a large part of the existing harbor installations; (2) it would reduce the shoreline available for development from 350 to 35 miles because ships will use locks only when unavoidable; (3) the evaporation and transpiration losses from the "fresh water" lakes would waste water; (4) it is not a satisfactory solution for another vehicular crossing of the bay because of the heavy concentration of traffic at either end; (5) established salt and fishing industries would be destroyed; (6) additional dredging of navigable channels would greatly increase harbor operating costs; and (7) sewage treatment disposal costs would be seriously affected.

Mr. Woodruff questioned the engineering feasibility of the Reber Plan's "fresh water" lakes. He stated that the spillway crest would have to be at El. +10 (high tide plus 3 ft. for wind and wave). Maximum flood flow over the spillway would raise the water level to about El. +14. Water at this elevation would flood immense areas, many of them highly developed, along the shores of the fresh water lakes.

According to Mr. Woodruff, the California Toll Bridge Authority is the only organization legally empowered to finance and build a second crossing without new legislation.

Public hearings were completed on Aug. 15. The board announced that it hoped to get its confidential report to the War and Navy Departments in time for the matter to be presented to Congress after the first of the year.



***New San Francisco Bay crossings** under study by the California Department of Public Works include eight high level bridges, a low level bridge and a subaqueous tube. Eighth bridge (shown but not identified on map) would be a high level structure costing $90,500,000 between Potrero Point, San Francisco, and Webster St., Alameda.*

OBITUARY

John Borland, 69, for the past 27 years a field construction engineer in the bridge department of the Cuyahoga County (Ohio) engineer's office, died at his Cleveland home August 11.

Emond I. Davis, 69, retired civil engineer who once served as chief engineer for the Corps of Engineers of the Republic of Peru, died Aug. 8 at his home in Grass Valley, Calif. Born in East Corinth, Maine, he was a graduate of the University of Maine, and began a long engineering career by joining the U. S. Bureau of Reclamation on its drainage investigations in the Mississippi River valley. He served with the Peruvian Corps of Engineers from 1909 to 1911, and from 1912 to 1914 was division and consulting engineer for the Puerto Rico Irrigation Service. He later served with the U. S. Army engineers, and was city engineer for Oswego, Ore., from 1933 to 1941.

Otis E. Randall, 86, dean emeritus of Brown University and former head of its civil engineering department, died at Providence, R. I. August 11.

George F. Ashton, 74, former city engineer of Salem, Mass., died recently at Salem. A graduate of M.I.T., he was first appointed city engineer in 1904.

Walter E. Cleapor, 53, a civil engineer employed at the Charleston, S. C. Navy Yard, died at Charleston recently.

J. D. A. Sauve, 64, vice president of the South Shore Construction Co. Ltd., and of Carnot Construction Co., Ltd., died August 12 at Montreal, Canada.

George W. Koontz, 60, civil engineer who specialized in railroad work, died August 9 at Memphis, Tenn. Born in Iowa City, Iowa, Mr. Koontz was a graduate of the University of Iowa and worked as a civil engineer for various railroads before joining the Frisco lines in 1922.

Frederick M. Cooper, 74, president of Edeburn Cooper and Co., Pittsburgh, Penn., civil engineers, died at his home at Coraopolis, Penn., August 12. A graduate of the University of Pittsburgh, he had been head of the engineering firm since 1910.

Commander Joshua T. Davis, 53, a construction engineer for the government, died Aug. 9, in Bethesda, Md. He had been in government work for 13 years. He was in charge of naval construction of the 48th battalion on Guam.

Swedish civil engineer students tour U. S.

A group of 32 junior civil engineering students and two graduates from the Royal Technical University Stockholm have just spent a month in the U. S., traveling 3,400 miles by bus to visit construction work and major engineering projects in the eastern half of the country. The groups were under guidance of Prof. G. Wastlund of the Royal Technical Institute and S. O. Asplund Stockholm contractor and associate professor.

Hydroelectric developments and recent advances in concrete construction were of particular interest to the Swedish students. The group comprised about half of the junior class of the institute, many of whom borrowed the money—about $1000 was required—to visit this country. They consider the money well spent. The group visited Boston, Syracuse, Niagara Falls, Detroit, Chicago, the Tennessee Valley, Pittsburgh, Philadelphia, New York and other cities.

Summer trips are a regular part of the curriculum of the Swedish schools but this is the first trip, so far as the group knew, to the United States.

Calendar of Meetings

NATIONAL

American Public Works Association, annual Congress, Texas Hotel, Fort Worth, Texas, Sept. 22-25.

The Producers' Council, Inc., fall meeting, Hotel Pennsylvania, New York, N. Y., Sept. 25-26.

Building Officials Conference of America, annual convention, Peabody Hotel, Memphis, Tenn., Sept. 30-Oct. 3.

REGIONAL

Pennsylvania Sewage Works Association, annual meeting, Pennsylvania State College, State College, Pa., Aug. 28-30.

American Water Works Association, Southeastern Section, DeSoto Hotel, Savannah, Ga., Sept. 9-11.

American Water Works Association, Western Pennsylvania Section, Roosevelt Hotel, Pittsburgh, Pa., Sept. 12-13.

American Water Works Association, Rocky Mountain Section, La Fonda Hotel, Santa Fe, N. M., Sept. 12-13.

Georgia Water and Sewage Association, annual meeting, in conjunction with 15th annual Georgia Water and Sewage School, Georgia Institute of Technology, Atlanta, Ga., Sept. 16-18.

New England Water Works Association, 65th annual conference, Poland Spring House, Poland Spring, Maine, Sept. 16-20.

American Water Works Association, Michigan Section, Park Place Hotel, Traverse City, Mich., Sept. 18-20.

American Water Works Association, Four-States Section, Brunswick Hotel, Lancaster, Pa., Sept. 27-28.

CONSTRUCTION ACTIVITY

As Reported this week to ...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of August 22 1946	Cumulative 1946 (34 wks.)	Cumulative 1945 (34 wks.)
Federal	$3,361	$507,301	$644,582
State & Mun.	37,433	921,112	206,390
Total Public	$40,794	$1,428,413	$850,972
Total Private	56,185	2,201,787	374,827
U. S. Total	$96,979	$3,630,200	$1,225,799

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Type of Work	Dollar Volume (Thousands) This Week	Cumulative 1946 (34 wks.)	Cumulative 1945 (34 wks.)
Waterworks	$3,171	$67,250	$34,479
Sewerage	3,054	66,180	20,894
Bridges	7,715	92,558	21,517
Highways	18,498	531,905	141,047
Earthwork, Waterways	1,852	287,852	32,286
Buildings, Public	6,163	259,773	396,504
Industrial	18,370	675,722	246,511
Commercial	36,927	1,298,656	77,505
Unclassified	1,229	250,304	255,056

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative (34 wks.) 1946	Cumulative (34 wks.) 1945
NON-FEDERAL	$1,110,541	$519,442
Corporate Securities	314,387	93,940
State and Municipal	571,154	261,902
RFC Loans	.....	24,600
REA Loans	.....	60,000
Fed. Aid Highway	225,000	79,000
FEDERAL	1,374,866	1,049,898
Total Capital	$2,485,407	$1,569,340

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	August '46	361.37	173.71
Building Cost	August '46	271.98	147.02
Volume	July '46	327	144

EDITORIALS

VOLUME 137 NUMBER 8

August 22, 1946

Construction Wage Changes

THIS MUCH CAN BE SAID in favor of the Wage Adjustment Board's announcement about wage changes made during the period July 1-25 when the board was not functioning (p. 69)—it puts contractors on notice that increases made during that period may not be approved, and so had better be held in escrow. Also it gives contractors a reasonable guide as to what type of increases will be approved. If the wage board follows through on its plan to publish its approved rates for various parts of the country in the *Federal Register*, and does that promptly, it may in the end help to clear up a badly confused situation. Too many federal boards now have a hand in fixing—or upsetting—construction wages.

Design for Uneven Settlement

AN ORIGINAL APPROACH to the problem of unequal settlement has been taken by the New Orleans Sewerage and Water Board in the design of a covered concrete reservoir (p. 98). To minimize cracking heretofore encountered in rigid reservoirs resting on unstable soil, this structure has articulated walls and a roof of thin precast slabs. These slabs are supported by pin suspension on projecting pipe columns to permit future vertical adjustment as needed. Originality of design goes beyond the structure itself and applies as well to the erection apparatus, particularly for raising and adjusting the roof slabs. While time alone can determine the effectiveness of this novel structure, the New Orleans engineers are to be commended for their strategy in seeking mastery over unequal settlement.

Suspension Bridge Vibration

COLLAPSE of the Tacoma Narrows Bridge in November, 1940, drew widespread attention to questions about aerodynamic stability of long suspension spans and started the most comprehensive study and analysis ever undertaken on bridge reaction to wind. The focal point for this study was the specially designed wind tunnel at Seattle, but there have also been inaugurated some field investigations with important potentialities. For example, an interconnected group of ten vibration-recording instruments recently installed on the Golden Gate Bridge should produce, for the first time, a complete record of just what happens when vertical and torsional movements stress and distort a long suspension span. (*ENR* Aug. 8, vol. p. 184) Such distortions were recorded in a dramatic and shocking manner in moving pictures of the Tacoma Narrows collapse, but it has remained for precise instruments to measure such vibrations exactly so that cause and effect can be fully and carefully analyzed. It is to be hoped that this will be done as soon as reliable results are obtained. There must be assurance that never again will a suspension bridge fail because of aerodynamic instability.

Sanitary Engineers in the Army

A PRESS RELEASE from the War Department this month bears the intriguing caption: "Postwar Medical Department To Give Vital Responsibilities to the Sanitary Corps." With much additional sugar coating, the release points out that many sanitary specialists, including engineers, are needed now in the regular army.

It is going to take a bit more than the laudatory terms of this release and the prospects it offers to attract sanitary engineers. Among other things, the Medical Department woefully under-rates the capacity and caliber of the engineer by classifying him as eligible for a commission in the Pharmacy Corps and eventually in a proposed Medical Service Corps! No less than the dentist or veterinarian, the engineer feels secure enough as a professional man to believe that if the Medical Department recognizes these groups as separate corps entities, then the least that can be done is to make similar provision for sanitary engineers.

Perhaps the best statement on this position is that of the ASCE Committee on Advancement of Sanitary Engineering (*Proc.* ASCE, May, 1946, vol. 72, no. 5, p. 654), which stated: "The grouping of nontechnical and technical personnel into one (Medical Service) corps, with highly indefinite educational requirements, seems to assure complete mediocrity, if it will work at all."

All of this brings focus on the oft-repeated question of why Army sanitary engineering is not completely severed from the Medical Department to form part of the Corps of Engineers. Sanitary engineers are not trained in medical schools. They are trained as engineers first and then as sanitary specialists. And it is the Corps of Engineers that designs, constructs and operates sanitary engineering facilities—a fact that became painfully apparent to many

a Sanitary Corps officer assigned by uninformed post medical commanders to such vital responsibilities as trapping fleas.

With all deference to the special abilities of medical men, one can properly question their qualifications for organizing, let alone administering, an engineering program. There have been occasions in the past when others have sought to assume the prerogatives of engineers in this regard, and the results—to put it mildly—have been discouraging.

Summing up the situation suggested by the War Department press release, the "vital responsibilities" offered by the Medical Department will, it seems likely, receive only apathetic consideration from able sanitary engineers.

Federal Construction Cost

PRESIDENT TRUMAN is to be commended for ordering federal department heads to make drastic cuts in their construction programs for the fiscal years 1947 and 1948 and for authorizing the Director of War Mobilization and Reconversion to declare a two-month moratorium on all new federal construction contracts during which time all federal projects now ready for contract are to be reviewed as to their necessity. No action that can be taken quickly could do more to check the continuing rise in the cost of construction, a rise that rapidly is reducing the amount of work that can be done with each dollar of construction money.

Today we are faced with a condition under which everyone operating in the construction field is competing with everyone else for labor and materials. Under such a condition costs are bound to rise despite all efforts at price control. Much of the resulting confusion is blamed on the OPA, and doubtless many of the scarcities have been aggravated by OPA rulings. Nevertheless, complete elimination of the OPA at the end of the fighting would not have made it possible to meet in so short a time the pent-up demands for housing and other types of construction.

Also, few people realize that heavy construction has risen to unprecedented heights in some classes of work and that the total volume for the first seven months of 1946 as recorded by *Engineering News-Record* is well over three billion dollars—a volume higher than the 12-month total for any of the ten years prior to 1940. Thus, highway work already let to contract has set an all-time high, and the commercial building work is almost double the previous record high.

Obviously then, this is a time to give more than lip service to the theory that our national economy —and with it the construction business—can be kept on more even keel by sharply curtailing federal expenditures when times are good, building up reserves of credit and projects for a time when business is slack. This the President has done.

Superficially, it might appear that this cut in federal work would have a bad effect on the construction industry and the many manufactures of equipment and materials that depend on it for work. We are confident that such will not be the effect. Manufacturers, generally cannot fill the orders now on their books for a long time to come, and construction contractors, similarly, are finding it difficult to complete the work in hand due to the scarcity of labor and materials. Lost time thus becomes a hidden item of cost in most bidding on new work.

Also, uncertainties as to the future cost of labor and materials, as to deliveries of materials and the efficiency of labor would make it necessary for contractors to bid so high on the federal work now to be held in abeyance as to make the awarding of contracts for that work highly questionable.

In other words, it appears quite probable that most of the work now put on the shelf would not have gotten under way this year—or should not have been put under way if due regard were given to costs—even though the President had not issued his order to stop letting contracts for more work.

Nevertheless, the President's order may have a far-reaching effect in checking the upward spiral of construction costs because it is the most conspicuous signal yet displayed to indicate that there are definite limitations to the amount of work that will be undertaken. Minor signals have appeared before, such as refusal of the Public Roads Administration to approve any road contracts that were more than 50 percent above 1940 costs, but they have not been widely noticed. Sharp curtailment of river and harbor work, of flood-control, power and irrigation projects, on the other hand, will be widely observed.

If the result does serve to check the upward spiraling of costs, every element of the construction industry will benefit.

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War's Outstanding Floating Bridge

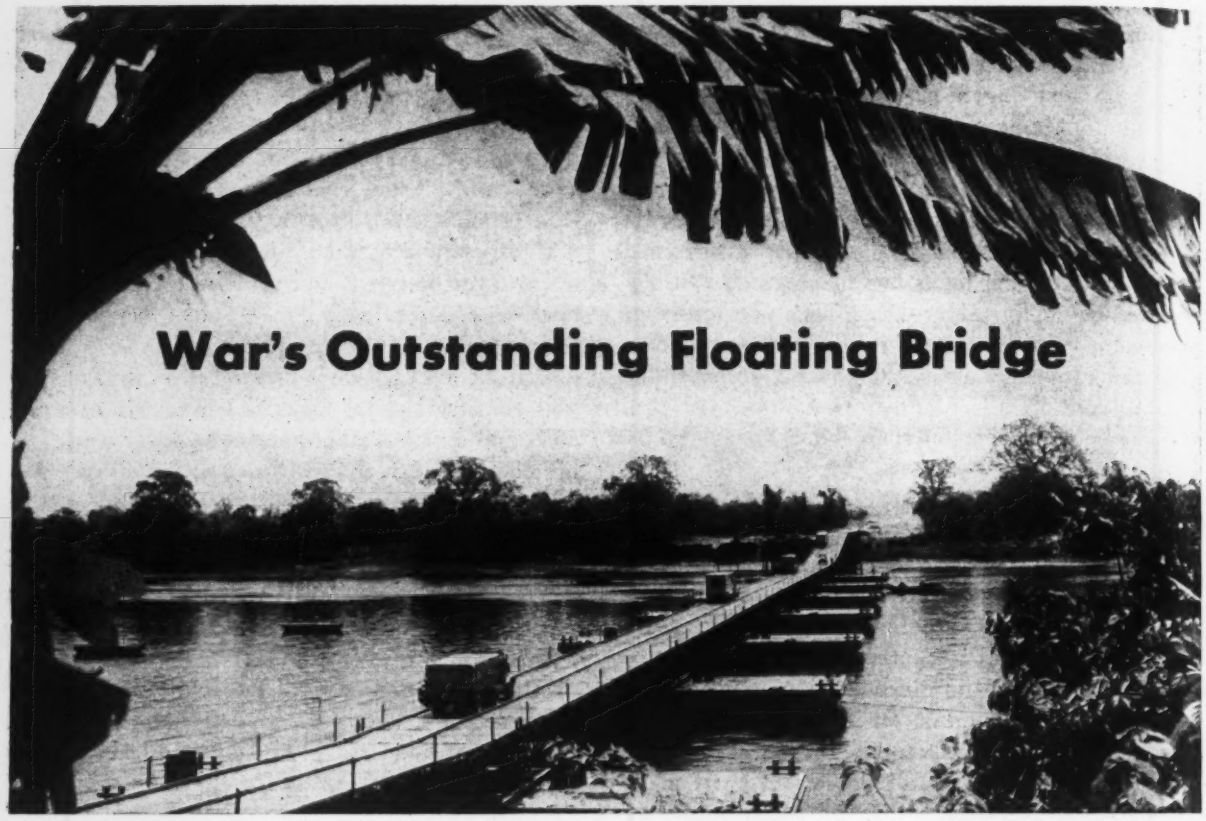

Fig. 1. A bridge adjustable to a wide range of river stages was used to extend the Lido Road over the Irrawaddy River.

***Contents in Brief**—To accommodate a wide fluctuation in river stage, a floating bridge with special transition spans at the ends was chosen to extend the Ledo Road across the Irrawaddy River in Burma. At the main channel four lines of box trusses supported on steel barges were used, and near each shore special adjustable piers, permitting both vertical and horizontal movement of the trusses, were constructed. The cable anchorage system was designed to permit removal of one span to accommodate river traffic.*

BEFORE the American construction forces were removed from the China-Burma-India theater, they built across the Irrawaddy River in Burma, as part of the Ledo Road project, what is considered by the U. S. Army Engineers to be the outstanding floating bridge constructed during the war. A combination of floating spans, fixed deck spans and ferry slip design, it was the only American-built floating military bridge specially designed for a specific location. By means of adjustable piers at the ends of the floating portion, the structure, (which at last reports was still in service) accommodates a 40-ft. variation in river stage, and is further distinguished by the fact that a section of the bridge at the main channel may be removed temporarily to accommodate river traffic.

The bridge is located about 20 miles south of the town of Myitkyina, where the stream is over 1,600 ft. wide, and the meager records available indicated that any satisfactory crossing would need to accommodate a 40-ft. fluctuation in the stage of the river. Preliminary studies also revealed that the depth in the main channel during low water would exceed 25 ft.; it was later found that the low-water depth was over 65 ft. at many points, and at one place was 105 ft. The maximum velocity at flood stage was estimated at about 8 ft. per sec.

In the preliminary studies, a bridge calling for steel trusses of 150-ft. span supported on fixed steel tower bents bearing on piling was considered, as was also a crossing with 150-ft. trusses and rock-filled timber cribs. A floating structure was the third design investigated. The first two proposals were ruled out because of lack of materials and the excessive channel depth, which would have restricted pier construction to the dry season and delayed completion of the crossing. The time element was the vital factor in favor of a floating structure, and experience with two pontoon bridges, one utilizing inflated rubber pontoons and one aluminum pontoons, emphasized that the Irrawaddy crossing would have to be of special design, because of the wide variation in the stage of the river and the swift current. The narrow roadway provided by the standard pontoon bridges also ruled that out as a solution for a permanent crossing.

The floating bridge that was finally built is shown in Fig. 1, and Fig. 2. Approximately 1,627 ft. long it provides a 22-ft roadway supported on four lines of deck trusses. In the main channel,

an 853-ft. floating section, supported on 7x29x104-ft. sectional steel barges spaced 137-ft. 6 in. center to center, was used. At either end of this portion there is a 228-ft. two-span transition section. Three fixed spans at the east end, varying in length from 88 to 117 ft., and supported above record high-water on timber bents, complete the structure.

The steel barges used for the floating section had been shipped to the CBI theater for use in moving supplies on the Brahmaputra River above Calcutta. They have a capacity of about 85 tons per ft. of draft above their light displacement of 16 in.

Sectional H-20 trusses used

The four lines of box trusses used, which were commonly known as H-20 box girders in the field, are of a type developed before the war and used extensively in the C.B.I. theater. They were designed to be of minimum weight for quick assembly as tactical bridges capable of carrying H-20 loads. Each truss is 2 ft. wide and 6 ft. deep, and is made up in 12-ft. 6-in. sections, joined by eight 1½-in. dia. bolts. To support the trusses, four transverse wide-flange beams surmounted by two longitudinal beams were installed on the deck of each barge.

In assembling the floating section, the trusses were made continuous for the entire 853-ft. length of this part of the bridge. This layout simplified construction, and the barges had such a large displacement per inch of depth that their yielding under traffic was not sufficient to overstress the trusses. Moreover, this design simplified the anchorage problem and the removal of the span at the navigation channel. Finally, the continuous design gave maximum rigidity against the forces of the current and the wind.

Support of transition sections

The floating portion was joined to each of the 228-ft. two-span transition sections by pin connections to permit vertical movement. The landward end of each transition section was supported at fixed elevation to rollers to accommodate horizontal movement (Fig. 2), while at the midpoint, a special pier was used as a support that could be varied in elevation, and at the same time permit longitudinal movement of the trusses.

This pier (Fig. 2 and 3), consists of two 42-ft. high steel-frame towers spaced 25 ft. apart in the clear. Spanning between the towers is a floorbeam

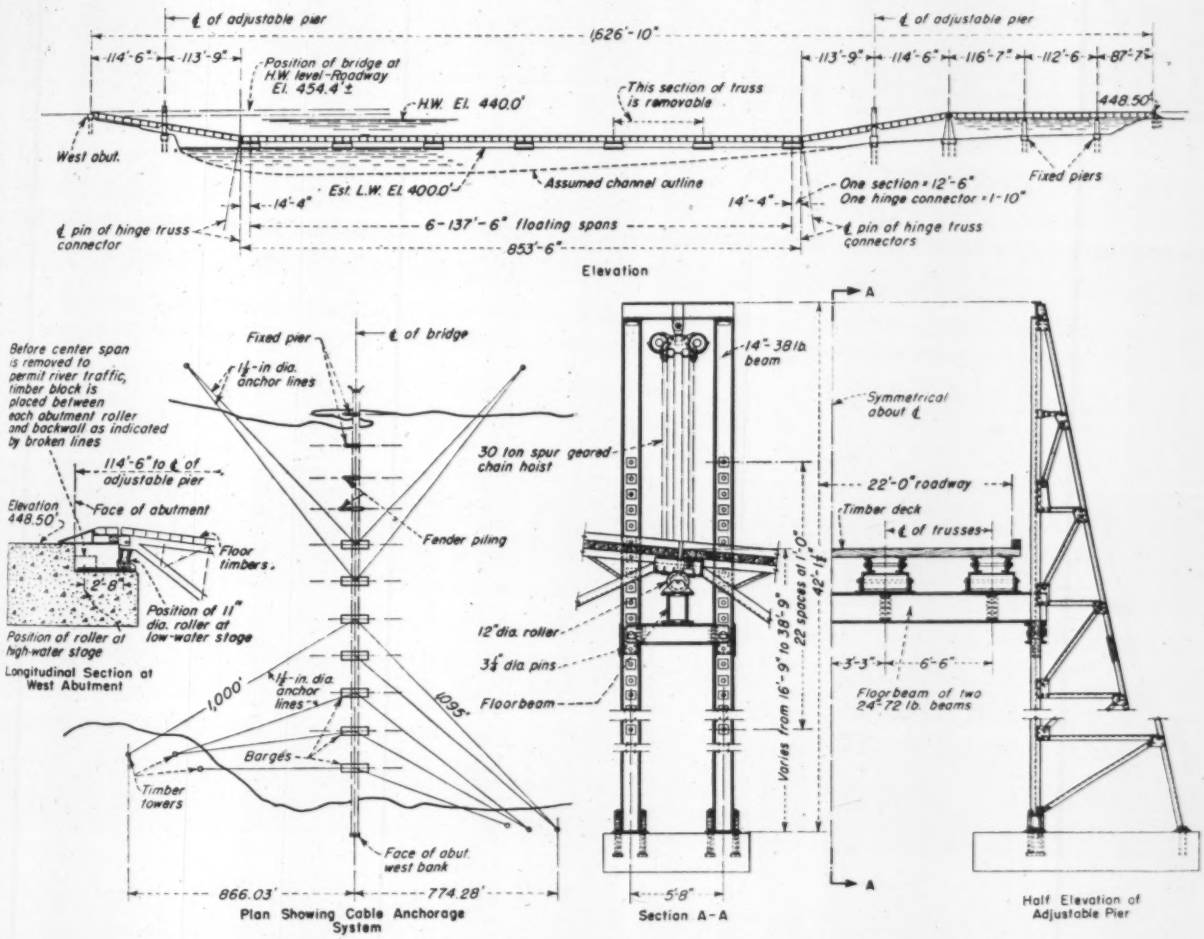

Fig. 2. The central portion of the crossing consists of steel trusses supported on steel barges, but at either end of the floating bridge a 2-span transition section is used, the landward ends being supported on rollers (left detail) and the midpoints on an adjustable support (center detail). Anchor cables were required both upstream and downstream of the bridges, as illustrated at the lower left.

built up of two 24-in. 74-lb. sections and supported at either end by cross-beams pin-connected to the inner tower legs, which consist of 14-in. 28-lb. wide-flange sections.

The holes for the 3¼-in. dia. connecting pins in the tower legs are spaced 1-ft. on centers. By means of a 30-ton chain hoist suspended at the top of each tower, the floorbeam may be supported while the pins are being shifted to the desired position for a given river stage. On top of the floorbeam, a 12-in. roller is provided under each line of trusses, which permits longitudinal movement. To provide flexibility, the trusses are also pin-connected at this point.

Construction of the three spans of the bridge supported on fixed piers is illustrated by Fig. 4. In driving the piling for these foundations, the hammer was handled by a small crawler crane mounted on a barge, air being supplied by two compressors transported on the same scow. The trusses were launched from the end abutment, being shoved forward by a bulldozer.

Fig. 4. At the east end of the bridge three fixed spans supported on timber-frame piers were used. In the background a bulldozer is pushing outward across the two spans already completed the fourth and last truss required for the near span.

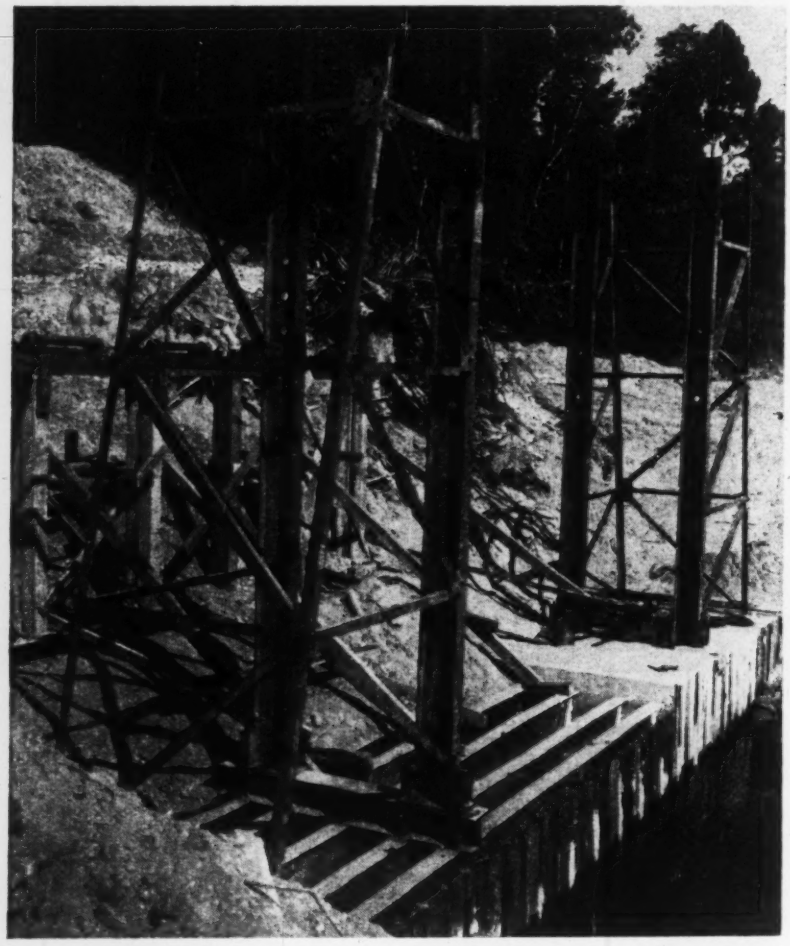

Fig. 3. Adjustable supports at the midpoints of the transition sections required two steel-frame towers 42 ft. high. A floorbeam resting on short beams connected to the towers by pins that could be readily shifted was installed between the towers.

Because of the large amount of drift carried by the river, it was inadvisable to anchor the floating section of the bridge by the conventional method of attaching lines to anchors in the river. Instead, a system of lines was devised attached to various shore points both upstream and downstream from the bridge and passing over towers located along the river bank (Fig. 5). All of the towers are of sufficient height that the cables, which are secured to conventional deadman anchors, are always clear of the water.

The anchor lines consist of 1½-in. dia. bridge cable, and all connections are by standard open sockets. Sheaves are provided at the top of each anchor tower to provide for movement of the cables. The desired tension in the lines, some of which are as long as 1,085 ft., is secured by hand-operated winches located on the barges.

Removable span required

This system of anchorage induces a considerable tension along the axis of the bridge—a force that builds up toward the middle of the river and complicates removal of a navigation span at the main channel. As a first operation in the removal work, therefore, two extra barges containing considerable water are moved under the ends of

the removable span and pumped out to support its weight. To relieve the tension in the connecting bolts at one end of the span, a ratchet lever hoist made up of a set of pulley blocks of 11-ton capacity is installed in all four lines of the trusses at that point. When sufficient pull is exerted, the connecting bolts are readily removed after which the jacks are slacked off to allow the two portions of the bridge to move shoreward until the rollers at the landward ends of the transition spans come to rest against the abutment backwalls. The bolts at the other end of the removable span are then quickly removed, and this section floated out. The span is readily replaced by a reversal of the method just described.

The adequacy of the design and construction of the bridge was proven by the fact that the crossing has met all traffic requirements and withstood several high floods. One of the floods came within 1 ft. of record highwater.

From information sent in from the field, design of the crossing was prepared by the Engineer Board, Fort Belvoir, Va., under the direction of Howard H. Mullins, chief of the structural design section. Revision of the design to meet field conditions was accomplished under the direction of Col. A. A. Welling, chief engineer of India-Burma theater.

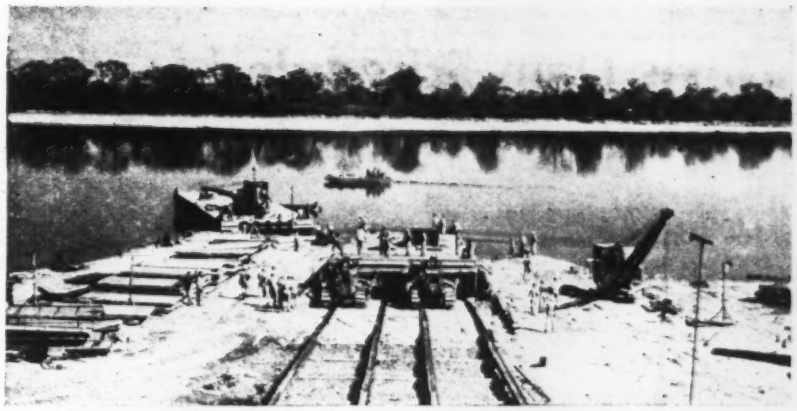

Fig. 6. Barges to support the floating spans were assembled on greased ramps and were launched by pushing them down the ramps with angledozers.

Construction was done under the general direction of Maj. Gen. Lewis A. Pick, formerly in charge of the entire Ledo Road project and now division engineer at Omaha, Neb., for the U. S. Army Engineers. Col. James Truitt assisted by Maj. George Burgett supervised the construction operations of the two companies of the 1007th Special Service Battalion assigned to the project.

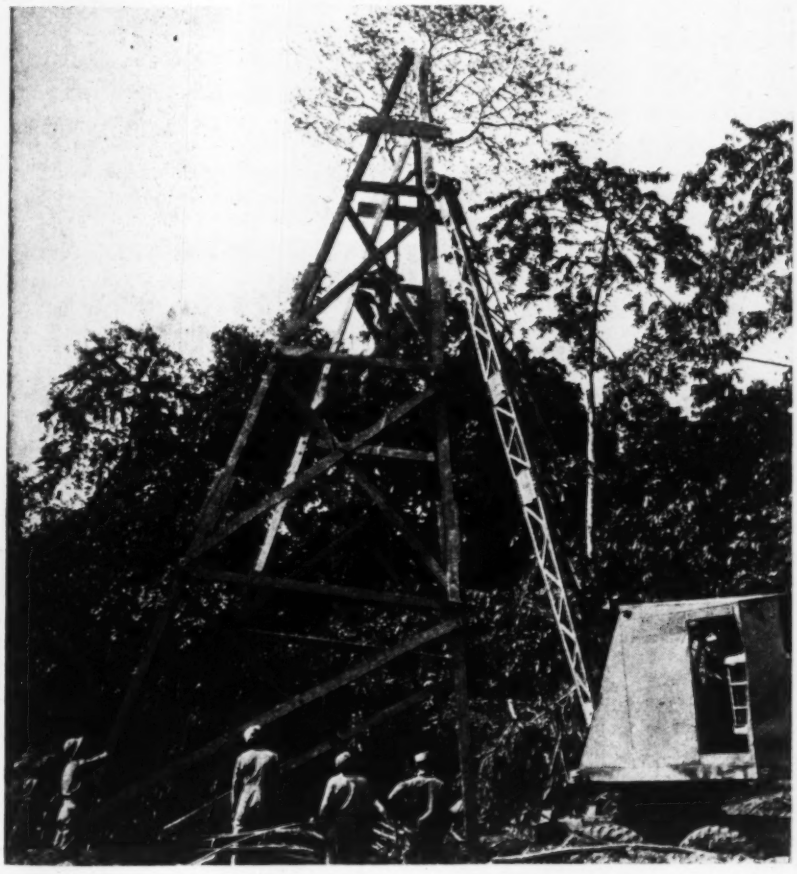

Fig. 5. Towers, as much as 60 ft. high, were installed along the shore, over which the anchor lines were passed to keep them clear of driftwood in the river.

Large Increase Found In Cars Needing Repairs

Efforts of the Minnesota Highway patrol to make travel safe for law-abiding motorists brought "must repair" tags in May to more than double the number of drivers given such tags in May last year, according to the monthly report of Earl M. Larimer, chief of the patrol division of the State Highway Department. Arrests and warnings for some types of traffic law violations also increased greatly.

Tags calling for prompt correction of illegal and dangerous equipment were given to 3,188 drivers in May. These tags indicated 4,797 violations, since many vehicles had more than one deficiency. Unsafe brakes, one headlight out and rear lights out were the most frequent.

Arrests for serious traffic violations, and comparative figures for May last year, included the following: driving under influence of intoxicants, 103 and 59; careless driving, 209 and 121; improper passing, 104 and 42; improper equipment, 186 and 98. On the other hand, there were decreases in arrests for excess speed, overweight loads and driving without driver's license.

Davis Dam Scheduled for 1949 Completion

***Contents in Brief**—Construction of Davis Dam on the Colorado River, stopped during the war, has been resumed. Major features of this $7,000,000 project, which will provide an additional source of power for the southwest, are a 3,900,000 cu.yd. earth-and-rock fill dam, a by-pass channel to handle a maximum flow of 60,000 cfs. during construction, and a power plant with an ultimate capacity of 225,000 kva.*

CONSTRUCTION of a 3,900,000-cu. yd. earth-and-rockfill dam, a 225,000-kva. power plant and a 4,500-ft. diversion and forebay channel capable of carrying a peak construction flow of 60,000 cfs. are highlights of the Davis Dam project on which work was resumed recently after a wartime shutdown. Scheduled for completion in 1949, this project, in addition to providing a source of power, regulation of releases from Boulder Dam, and additional flood protection at Needles, Calif., will fulfill an obligation incurred by the United States in connection with the Mexican water treaty (*ENR* Jan. 25, 1945, vol. p. 123).

Construction of Davis Dam practically will complete the development of the Colorado River from Lake Mead to the Mexican border. Other possible future developments in this area are additional pumping and canal facilities in Arizona with water coming from Parker Dam and expansion of facilities at Imperial Dam.

Located in Pyramid Canyon of the Colorado River 67 mi. below Boulder Dam and 75 mi. above Parker Dam, Davis Dam has been under study by the Bureau of Reclamation for many years. Originally called Bullshead Dam because of the shape of a rock formation near the site, the dam was renamed in 1941 in honor of Arthur P. Davis, chief engineer of the Bureau of Reclamation at the time early studies were made on the development of the Colorado River.

For reregulation of the flow

Davis Dam will be used for power generation and as an afterbay dam for Boulder to provide better control of the river flow. Use of Davis Dam for river control is required by the Mexican water treaty. The following provision in the Davis Dam authorization act (passed by Congress in 1941 when negotiations with Mexico for the water treaty had just begun) shows the relation of Davis Dam to such a treaty:

"When the waters of the Colorado River are apportioned between the United States and Mexico by international agreement, Bullshead Dam will serve an important function in providing that fine degree of control needed in effect to meter out the water in accordance with a treaty or agreement. This potential future use has been taken into consideration and is a motivating factor in proposals to build the project, though no costs have been allocated to it."

Under the provisions of the Mexican water treaty, the United States agreed to build Davis Dam at its own expense within five years after the treaty went into effect. As the treaty became effective in 1945, the dam must be operating by 1950. Accordingly, completion by 1949 is called for in the contract for construction of the dam. As this contract does not cover installation of the generators and other electrical and hydraulic apparatus nor such finish work as power plant and intake structure doors, windows, louvers, stairways, etc., additional time will be required before final completion of the project.

Reclamation projects in this region often include irrigation as one function. However, relatively high pump lifts would be required at Davis Dam

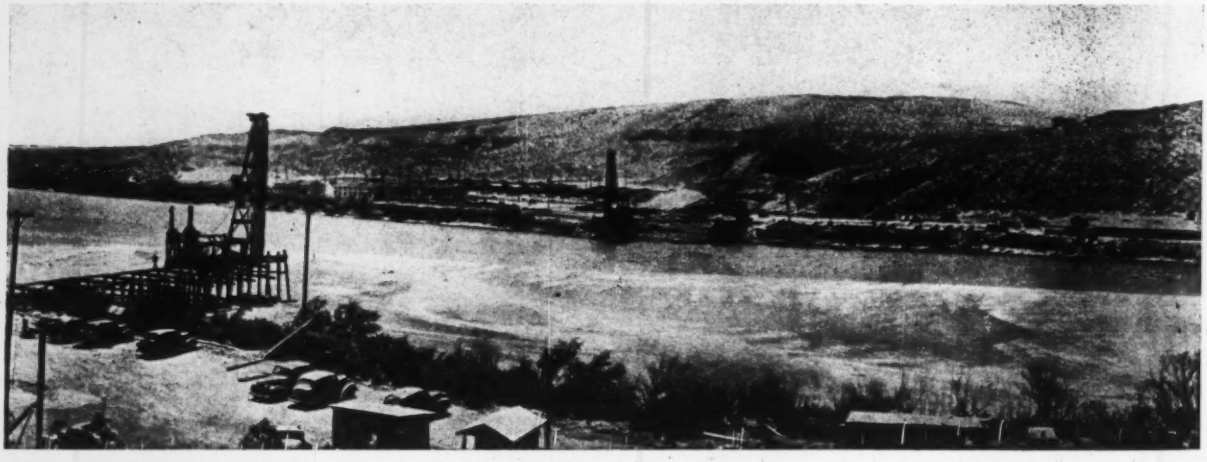

Fig. 1. Across the Colorado River, living quarters for contractor's personnel are under construction; at the left re-assembled army barracks, and in the background single family residences. The piledrivers are on one of the three new trestle bridges.

to use water for irrigation. Therefore, all of the costs for the dam are to be allocated to power. Under prewar conditions it was estimated that power revenues from Davis Dam would pay off its cost in 50 years with interest at 3 percent.

The initial contract for construction of the dam was let in June, 1942, to the Utah Construction Co. for $18,996,392. Work was barely started when, in November, 1942, a War Production Board order stopped it.

A new contract, the biggest single contract to be let by the Bureau of Reclamation since the war, was awarded, again to the Utah Construction Co., in February of this year for $21,462,505. The increase in contract price is due partly to increases in labor costs (*ENR* Apr. 18, 1946, vol. p. 663) and partly to changes in the design since 1942. In addition, the new contract price does not include the cost of supplies, plant and equipment valued at $1,140,000 obtained by the government in 1942 in the process of termination of the original contract.

$77,000,000 project

The Davis Dam project in its entirety will cost some $77,000,000. The contract held by the Utah Construction Co. does not include the generators, turbines, transmission lines, and finish work previously mentioned.

The Utah contract includes 15,000,000 cu. yd. of earthwork (some material will be handled two or three times) and the bid price ranges from 10 cents a yard for rock screenings in the dam embankment to $30 a yard for excavation in tunnels and shafts. Also included is 455,000 cu. yd. of concrete work. The bid price on this ranges from $8.90 a cu. yd. for concrete in the massive sections of the intake structure to $67.50 a cu. yd. for concrete in the superstructure of the power plant.

Details of the dam

As already stated, major features of the project are the earth-and-rockfill dam, the diversion and forebay channel, and the power plant. The 50-ft. wide crest of the dam will be some 138 ft. above the river bed and will be approximately 1,600 ft. long. The central or impervious portion of the dam (Fig. 3) will be placed in 6-in. compacted layers and will consist of a moistened and rolled embankment of clay, sand, and gravel with a blanket of the same material extending over the entire upstream portion of the foundation of the dam. The portions of the embankment immediately upstream and downstream from the impervious portion will be semi-pervious and will consist of moistened rock screenings, 4 in. or less, rolled in 12-in. compacted layers. The upstream and downstream portions of the embankment will consist of fills of rock 4 in. or greater.

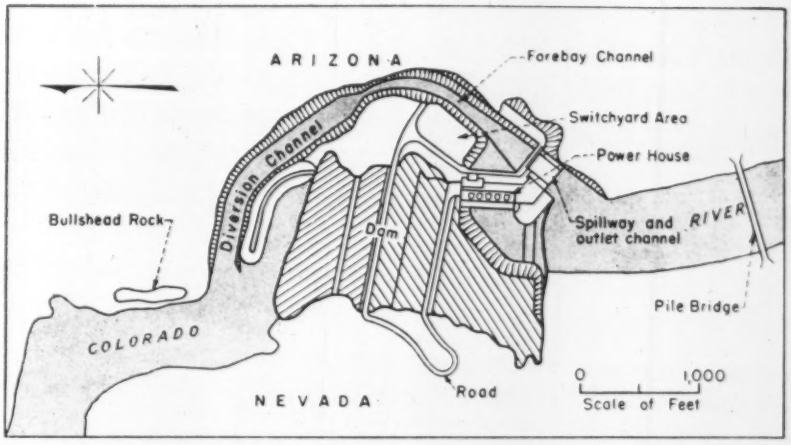

Fig. 2. This plan view shows how the diversion and forebay channel skirts the Arizona abutment of Davis Dam. Situated between the two are the power plant and switchyard.

A cutoff trench with a bottom width of 120 ft. will be excavated to a depth greater than 60 ft. across the river bed. The depth of the cutoff trench across the river bed may be increased depending upon conditions disclosed during the progress of the excavation. Cutoff trenches on the abutments will be excavated to firm rock. Concrete cutoff walls will be constructed in the bottom of the cutoff trenches on the abutments. No cutoff walls will be used in the trench across the river bed.

An interesting sidelight on the design of this dam becomes apparent on comparison with Parker Dam some 75 miles downstream. At both sites bedrock below the river bed is covered with 150 to 200 ft. of deposited and broken material. Davis Dam is to be built virtually on top of this river fill (the cutoff trench is planned to be only some 60 ft. below river bed), while at Parker the engineers chose a concrete structure and founded it on rock, with the result that 235 ft. of its 350-ft. height is below the river bed.

The impervious material for Davis will be obtained from a borrow pit of suitable materials some three miles from the dam. The main source of the pervious and semi-pervious material will be the diversion and forebay channel excavation. The material in this excavation is of igneous origin, consisting mainly of hard broken gneiss. Experience with the gneiss during the early phases of excavation work has shown that it will break up readily when exposed to the elements and to ordinary handling. The resulting product is expected to meet the design requirement of a stable, semi-pervious material with a rather low permeability rate so that it will function both as a comparatively impervious material with respect to the foundation and outer layer, and will be pervious compared to the core of the dam.

The reservoir formed by Davis Dam will back up to within one mile of Boulder Dam and will contain, when filled to normal water surface elevation, about 1,820,000 acre-ft of water. Under normal operating conditions, water will pass the dam through the power plant. However, when additional flow is required for downstream use, it can be passed through the spillway structure by use of 19x22-ft., radial, hydraulic gates operated under about 100 ft. of head.

Diversion and forebay channel

A second major feature of the project and the only part now under construction is the 4,500-ft. diversion and forebay channel. The upstream or diversion portion of the channel will have a bottom width of 200 ft. and the forebay portion will be 75 ft. wide at

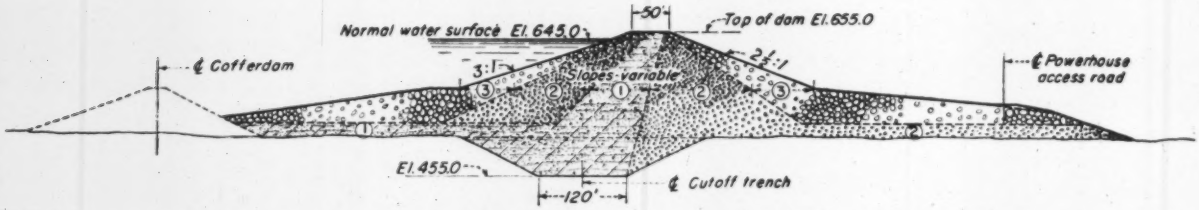

Fig. 3. Plans call for the dam having a central core of impervious material (1), a layer of semi-pervious material on each side (2), and a final layer of larger rock (3) to provide the required mass.

the bottom, the width increasing at the downstream end to accommodate the forebay structures. The maximum cut will be about 220 ft.

Present plans call for completion of the diversion and forebay channel first so that it may be used as a diversion channel while the rock-and-earthfill dam is under construction. Preliminary plans of the bureau called for diversion during construction to be through six 29-ft. diam. tunnels on the west bank (Nevada side) of the river, one to be concrete lined and used as a generator bypass after completion of the dam. Additional design studies showed that definite economies would result from the open channel construction as shown on the drawing, placing the channel on the Arizona side of the river.

The forebay channel will be concrete lined for 1,070 ft. upstream from the forebay structure. Although the maximum cut for the channel will be some 220 ft., it will be lined only up to maximum water surface, to a height of 150 ft. The lining thickness will be 12-in. minimum and 18-in. average. The heavy reinforcing will include 1¼-in. anchor bars set at least 4 ft. into the rock. Contraction joints will be spaced at 15-ft. intervals and tile drains will be placed behind each contraction joint in the wall of the channel, with a central system to collect the water from each drain.

Because of the height (150 ft.) and the relatively steep slope (½ to 1) of the walls, this channel lining is considered to be one of the project's most difficult construction features. Concrete work is not expected to start until late this year or early in 1947.

Outdoor-type power plant

The Davis power plant will be an outdoor type and will be located on the Arizona side at the end of the forebay channel. The power plant structure will be of reinforced concrete and will have space for five main generating units. Each unit will be a 45,000-kva., vertical-shaft generator driven by a direct-connected 62,000-hp. turbine.

Water will be brought through the intake structure from the forebay channel to the turbines by 22-ft. diam. steel penstocks. The turbines will operate under a head varying from 57 ft. at minimum water level to 134 ft. at maximum high water level.

The intake structure will be of massive concrete construction, some 120 ft. thick at the bottom. A concrete cooling system to be installed for this structure, which will also be used for cooling the lining in the forebay channel, will be served by an ice plant installed for the purpose.

Sequence of operations

The first construction job will be the excavation and concrete work in the intake structure and the diversion and forebay channel. When the channel is completed it will be used for diversion of the river while excavating for the foundation of the dam and constructing the embankment. The final operation will be the actual building of the dam and the power plant. The construction schedule set up by the Utah Construction Co. calls for completion in June, 1949, which is not much in advance of the July 5, 1949, completion date in the contract. It is not expected that the river will be diverted until 1948.

Rock excavated from the channel site is to be used in the dam and so it is being stockpiled for future use. Grizzlies will be installed to sort the material into two sizes; one passing through and one rejected by 4-in. bar spacings. These two sizes will be stockpiled separately. In this manner, rock for the dam will be handled several times. The sequence will be (1) excavate, (2) sort by grizzly, (3) stockpile, and (4) place in the dam.

Fig. 4. These two trucks are coming down an 18 percent grade on a hill which will be completely removed in excavating a canal 220 ft. deep.

Besides initial excavation, the work now being done at the site includes the construction of the housing, shops, and other facilities necessary for a force which will number about 1,200 for Utah alone at the peak of employment.

The Utah Construction Co.'s housing facilities will include 50 single-family dwellings, 7 apartment buildings for five families each, 50 war surplus house trailers and 10 Army surplus barracks. In addition to housing, the company's plans for its construction city include the following: hospital, school, recreation center with swimming pool, church, store and mess hall.

The Utah Construction Co. is installing two complete water systems, one for its industrial area and one for the domestic area. Each will use water pumped from the river to two (one for each system) 200,000-gal. redwood-stave tanks located so that a minimum pressure of 65 psi. will be available for fire protection. Water for both systems will be chlorinated, and the domestic water will be softened to 100-ppm. hardness by a zeolite softening plant with a ½ mgd. capacity.

Sewage disposal facilities

The contractor also is installing a central sewerage system and an Imhoff tank. The Arizona Department of Public Health is requiring that, in addition to chlorination, the effluent be ponded for 30 days before being returned to the river. A 10-acre pond is being constructed nearby for that purpose.

Other initial work includes the construction of three wooden trestle bridges across the river, one of which will be used exclusively as a haul bridge. One of the others will be used for dumping fill in the downstream cofferdam.

Although materials shortages are affecting the rate of progress on the dam and on the incidental facilities, work is going ahead. Construction employees are being housed in offices, shops and any available shelter in the surrounding desert pending completion of housing facilities. The Bureau of Reclamation has awarded a contract for construction of living facilities, for its employees at the site. However, because this contract was let later than the Utah contract, the bureau's damsite city has not developed as quickly as has the contractor's.

The Davis Dam project was designed in the Denver office of the Bureau of Reclamation under the direction of Walker R. Young, chief engineer. H. F. Bahmeier is construction engineer for the bureau. H. E. Williams is project manager for the Utah Construction Co., and T. L. Terry is general superintendent.

Geological Survey Topographic Maps Are Now Available to Those Interested

A summary index has been prepared showing areas of the United States for which topographic maps are published by the Geological Survey. Also covered by the Survey's topographic maps are Hawaii, Puerto Rico, and half of Alaska.

To date about 48 percent of the area of the United States has been topographically mapped in some manner. In the index, a tentative appraisal of existing maps is made, differentiating the maps considered adequate for general use from those requiring extensive revision or resurvey to meet present-day engineering requirements. A few of the earlier reconnaisance maps formerly distributed by the Geological Survey, but now considered entirely inadequate, have been withdrawn from distribution.

Most of the maps considered adequate for general use would need a revision for those development projects requiring up-to-date information on roads, buildings, and other works of man. Such revisions are included in the Geological Survey's long-range plans for topographic mapping. In general, the "adequate" class includes maps based on surveys made since the early 1920's. At that time the standards of mapping were raised above those of earlier years when expedience demanded relatively rapid coverage in order to spread the limited mapping capacity over the greatest possible area.

The Geological Survey is now studying the problem of developing criteria that may be readily applied to previous mapping and yet be adequate for actual requirements. A study will soon be undertaken, in collaboration with other agencies, to appraise all other published topographic maps on an equivalent basis. This appraisal of the entire topographic mapping situation may be completed soon.

Index maps for each state

The Geological Survey publishes index maps of each state showing the names and locations of all topographically mapped areas, geologic folios, and river surveys produced by the Survey within the respective areas. Dates of surveys as well as planimetric maps, heretofore omitted, are now shown. These indexes, which are furnished free, also describe the geologic and other reports published by the Survey as well as the special state maps and those covering the United States. Local agents distributing these data are listed, and a general statement describing the topographic maps and the manner in which they may be obtained, is also presented.

Heretofore, indexes have been revised every few years for states having active mapping projects, but more frequent revisions are planned. Meanwhile, supplemental sheets are being prepared listing all maps published since the index was printed in order that the recipients may have up-to-date information regarding available maps.

The Survey prepares statements monthly, listing all new publications issued during the month. These lists are available from the Geological Survey, and the professional papers, bulletins, and water supply papers may be purchased from the Superintendent of Documents. Maps, however, must be obtained from the Director of the Geological Survey, Washington 25, D. C., to whom remittance should be sent by money order. A circular entitled "General Information Concerning Maps Published and Sold by the Geological Survey" is also available on request. Those desiring information concerning maps produced by all government agencies are referred to Price List 53-MAPS, a 16-page circular issued free by the Superintendent of Documents, or to the Map Information Office of the Geological Survey.

Milk Plant Designed for Rapid Erection

***Contents in Brief**—Among the special features of a 4-story milk processing and bottling plant now under construction is a floor system designed for rapid, economical erection. To simplify formwork, concrete beams, comprising a 2-way reinforced system supported by steel girders, are all cast 8 in. wide. While depths of members vary from floor to floor, at any one level they all have the same depth. The architectural treatment and installed equipment are also worthy of note.*

A FLOOR SYSTEM composed of steel girders and concrete beams of the same depth made possible rapid and economical erection of a multi-story milk processing plant. The architectural treatment of this structure and much of the installed equipment are unique.

The 4-story milk processing and bottling plant is being built for the Dairymen's League Cooperative Association, whose present New York City distribution center has been displaced by a housing project. Costing over a million dollars, the new plant will have a daily capacity of about 60,000 gal. (shipped in more than 300,000 glass, paper and metal containers), which is about the same as that of the old plant. However, all operations, including those in the storage and service garage, will be under one roof, and from the time the milk enters the building to the time it leaves, it will be handled mechanically through stainless steel pipes and tanks.

Centrally located in midtown Manhattan on a 55,000-sq. ft. site and fronting on the west side elevated highway along the Hudson River, the milk plant consists of two structures—the main plant and a garage (Fig. 1). A covered driveway of 60-ft. unobstructed width and 200-ft. length, joining two cross streets, connects the two buildings and provides protected space for loading along a platform that runs the full rear-wall width of the main building. Natural light is provided by vacuum glass block inset panels in the roof of the driveway.

The 2-story, steel-frame garage is entered at grade from the covered driveway through a series of openings with overhead doors. A street entrance is provided for the garage repair and maintenance shop, which has openings to the garage proper protected by fire doors. The second floor of the garage is connected with the driveway by a ramp with about a 12 percent slope. Above the ramp, a monitor-type skylight ventilator admits light and air to the ramp and the second floor; exhaust fans keep the area smoke-free.

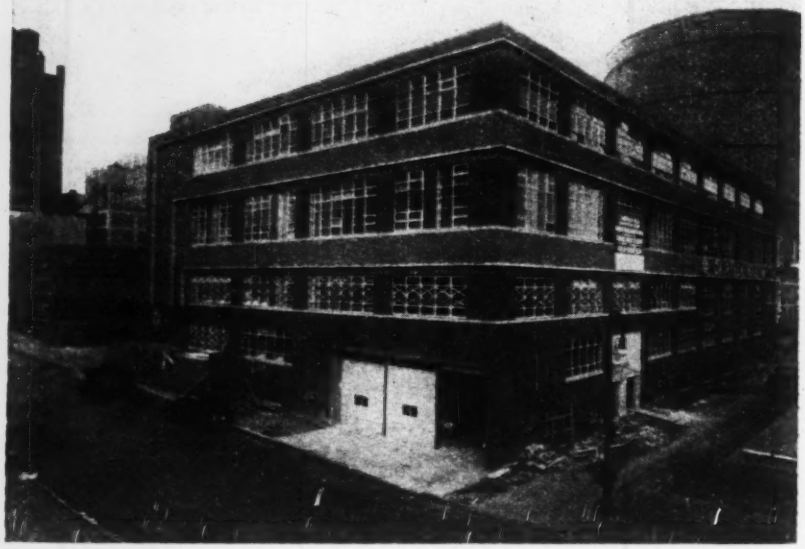

Fig. 1. Steel-frame brick-enclosed milk distributing plant in New York City has a drive-through roadway and two-story connected garage at left.

Future changes in floor considered

The main plant has a skeleton steel frame, is 200.8 ft. by 110 ft. in plan and includes four upper stories of varying height, a basement and boiler room. Its design considers the possibility of conversion of the structure to other uses than milk processing. For example, second-floor beams are bolted to the columns, and the second floor may be removed without affecting the stability of the building. Part of this level is omitted over the main bottling area, and a glass-enclosed observation corridor is provided along two sides of the open well for public inspection.

In addition, all floors are designed with the idea of possible future modification; this is accomplished by the use of steel framing between steel columns, so that any one panel can be altered independently (Fig. 3). At the same time, the framing is designed to effect a minimum construction thickness. The ceiling level under all beams and girders is constant throughout any floor, thereby reducing trapped air pockets and shadows from ceiling lights and simplifying the work of hanging the maze of piping necessary in food-processing plants.

Concrete floor slabs are 5 in. thick, designed for a live load of 200 lb. per sq. ft. on the second and fourth floors, and of 300 lb. per sq. ft. on the first and third floors. The 4½-in. thick roof slab is designed for a live load of 40 lb. per sq. ft. Continuous wire mesh 2-way reinforcement, crimped upward near the supports to provide for negative moments, is used in floors and roof.

The panels are supported in two perpendicular directions at about the third

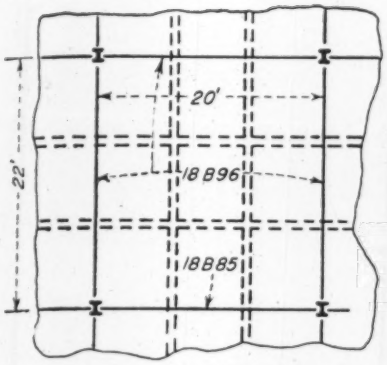

Fig. 2. Typical panel, formed by steel girders spanning between steel columns, is supported by 8-in. reinforced concrete ribs acting as two-way system.

Fig. 4. Beams and girders supporting each floor of the milk plant are of equal depth.

points by concrete beams or ribs spanning between the steel girders. To simplify the form work and facilitate erection, the ribs throughout the entire building are 8 in. wide. On any one floor, the ribs and concrete-encased steel girders have a constant depth, with 20½ in. used for the roof, 21 in. for the second and fourth floors, and 23 in. for the first and third floors.

Variation in beam depth between floors, especially from 23 in. for the first floor to 21 in. for the second and then back to 23 in. for the third floor, posed a problem in forming since the undersides of the floors are to be permanently exposed and plywood for the forms was almost impossible to procure. But detailed planning of the forms for each floor before cutting any of the wood resulted in the development of an adjustable arrangement that permitted re-use of the forms with little trimming.

Forms for concrete encasement of

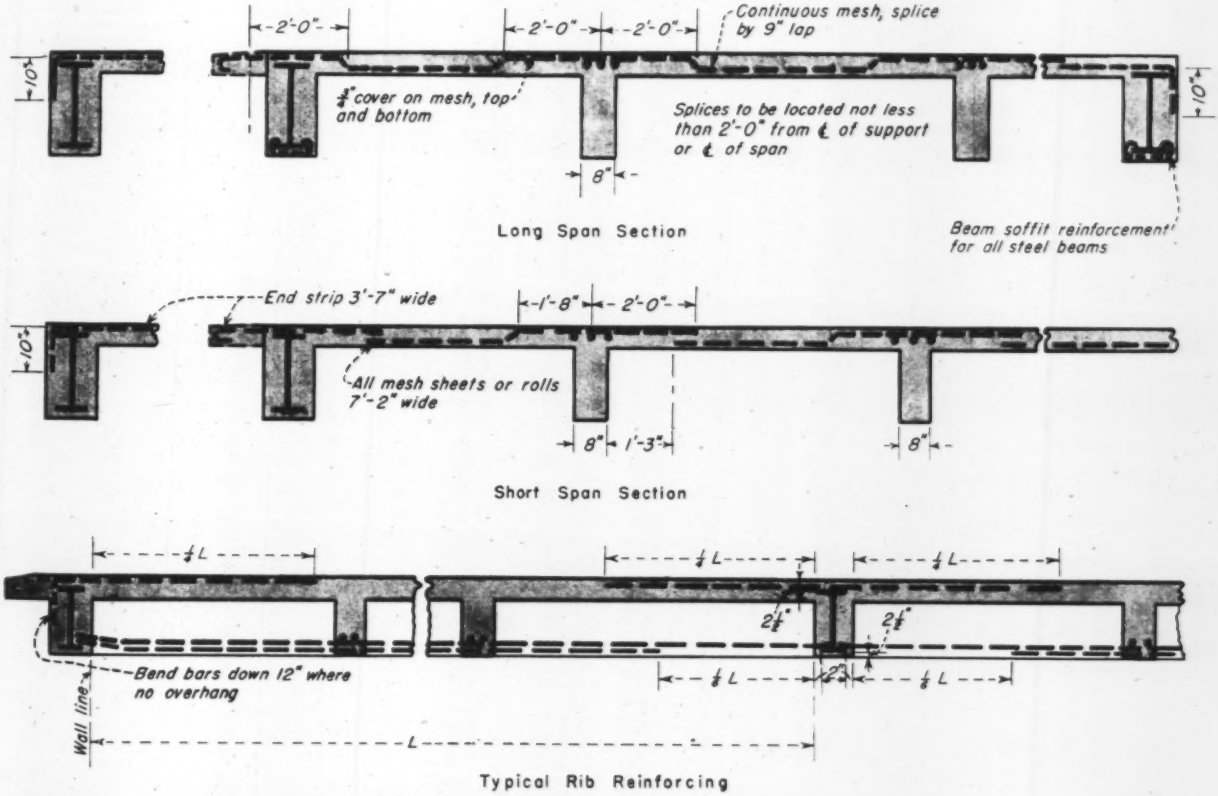

Fig. 3. Sections through typical floors of the milk plant showing method of reinforcing the ribs (bottom) and slabs (top).

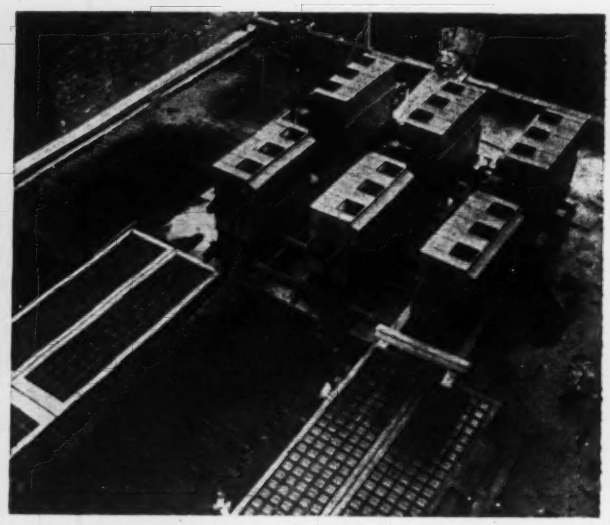

Fig. 5. Condensers for ice machines occupy driveway roof. Glass-block panels supply daylight to the interior.

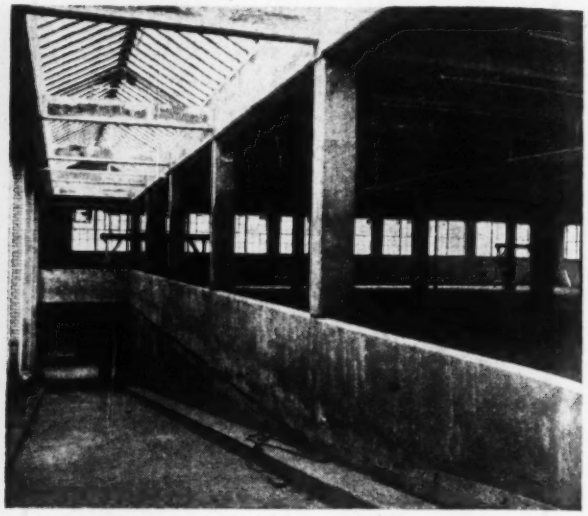

Fig. 6. Ramp providing access to second floor of garage receives light and air from overhead skylight ventilator.

the steel girders were carried on beam hangers, whereas forms for the concrete beams were supported at intersections and mid-points by adjustable wood shores (Fig. 6). Stripping was accomplished by temporarily removing the supports and loosening the forms at prepared corners so that side and bottom forms might be dropped. The members were reshored, at the beam intersection points only, and this shoring was removed after concrete was placed for the two next higher floors.

The panels were assumed in design to act as a 2-way system. The load was distributed to the various members and moment coefficients computed on the assumption that the deflections at the points of intersection of the ribs are equal.

Panels are 20x22 ft., the 10 percent difference in span being due to the desire to economize by developing the reinforcing in all ribs to the fullest extent. In the short direction, the reinforcing bars are placed below those for the long direction for positive moment, because of the greater load carried in the short direction. Thus, the steel in the short direction has the greater moment arm, and the load-carrying capacity of the ribs in both directions are about equal. Reinforcing details are shown in Fig. 3 and 7. Practically all of the bars are straight.

Provision is made for pipe-sleeve openings through the various floors for the connection of service and utility lines. These sleeves are of welded pipe and collars in unfinished rooms; where brick-tile is used the sleeves are formed with rectangular stainless steel boxes that are flashed into the waterproofing of the respective floors and extended 4 in. above the finished floor level to prevent any flow of washwater to a lower level. Pipe ducts are of masonry and are provided with access doors at all floors. In addition, metal inserts are cast into the concrete ceilings at convenient locations and in the bottom of all ribs at intersections so that future piping and other equipment can be hung without the necessity of drilling or damaging the ceiling surfaces in any other way.

The floor in the boiler room, under which a structural-weight slag block was used, is designed to resist uplift from maximum high tide and to prevent any infiltration of exterior moisture. All walls below street grade are of concrete, and concrete foundations extend at least one foot into bedrock. To avoid the possibility of exterior water entering the basement and boiler room, all walls and floors below maximum recorded high tide level are separated from the rock surface by open-tile drainage layers connected to sumps with automatic pumping arrangements.

The architectural design of the plant is purely functional, following the modern trend. A minimum of ornamenta-

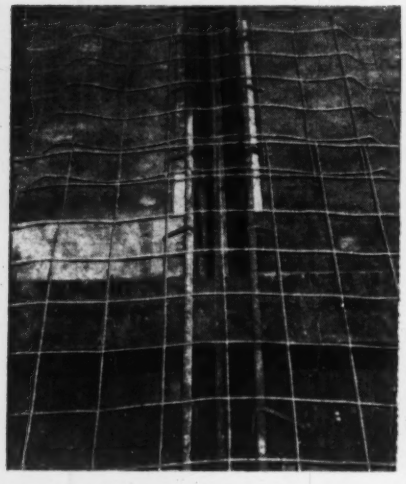

Fig. 7. Wire mesh reinforcing of slab, crimped for negative moment, rests on negative rib reinforcing, which in turn sits on flange of the steel girder.

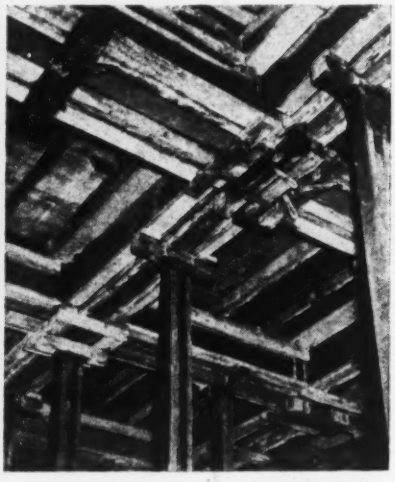

Fig. 8. Plywood forms were planned to permit easy stripping and re-use, although beam depths at the successive levels were 23, 21, 23, 21 and 30½ in.

tion in the exterior elevation, with a maximum of window openings, is used to provide a pleasing appearance.

All wall sections below the second floor level are composed of a dark shade (almost black) of select common brick with a high manganese content—specially treated to decrease porosity and increase hardness. This type of masonry was selected to avoid the possibility of discoloration, a condition that must be expected due to the proximity of the structure to shipping and other industries. Above the second floor, the spandrels, piers, and parapet are faced with brick in varying shades of dark, medium and light red—corresponding to the shades normally obtained from the kiln. At the bottom of the spandrels are horizontal bands of concrete formed by projecting the slabs 9 in. beyond the face of the wall.

The same general design is carried through to the exterior walls of the garage at the rear of the main structure, except with more severe lines and less variation in color. In this way the two buildings are tied together, and yet the greater importance of the main structure is indicated.

Milk attacks concrete

Design of the interior was controlled by the necessity of providing smooth surfaces for sanitary reasons, as well as surfaces resistant to lactic acid, which is contained in milk and which attacks concrete. Thus, interior walls of the office space, production area and loading dock are lined with ceramic, glazed, terra cotta tile blocks built monolithically with the wall (Fig. 2). This type of facing is carried to ceiling height; coves and bull noses are used to eliminate dust pockets, thus facilitating cleaning.

The ceiling in the office areas is covered with a sound-absorbing material. All other ceilings are of exposed concrete, except in the cold room where cork board insulation is suspended from the ceiling.

Floors in all milk-processing rooms, except those of the cold room, are of standard, dark-red brick tile laid with tight joints of acid-resisting mortar. The floors are sloped to facilitate proper drainage into floor drains. Cold room, loading platform and driveway floor surfacing is of light-colored, repressed paving brick laid with tight joints on a concrete base, properly sloped to provide adequate drainage. Walls of the cold room have coved brick-tile bases, and the tile floor is separated from the concrete base by a continuous mat of waterproof material.

Floors with concrete wearing surface are provided in the garage and the basement of the main building. In the boiler and engine rooms, floors consist of 1¾-in. heavy duty brick-tile laid on a concrete bed. All sidewalks and curbs, including driveway base, are concrete with special hardener and scale-resisting admixtures.

The main building and garage are covered with an asphalt and gravel roof, the roof of the former being insulated with 1-in. cane fiber board.

Other interesting architectural details are summarized in the accompanying table.

The milk plant was designed by Jacob Feld, consulting engineer of New York for the Dairymen's League Cooperative Association, for whom Amos J. Vroman is chief engineer. Cauldwell-Wingate Co. of New York City holds the general contract for construction, Moccia Construction Corp. of New York the subcontract for concrete, and Karl Koch Erection Co. of The Bronx, N. Y., the subcontract for steel erection.

ARCHITECTURAL AND ENGINEERING FEATURES

MATERIALS

Item	Location	Remarks
Masonry mortar		Conforms with brick composition to reduce efflorescence
Copper flashing	Various levels	To reduce efflorescent discoloration
Aluminum sash	Main plant	Provided with interior operating mechanisms
Steel sash	Garage	
Aluminum screening	Main plant	Plastic mesh to be used when available
Plate glass		Double thick, clear polished
Glass block	Driveway roof	Vacuum block inset panels
Cork board	Cold rooms	4 and 6 in. thick—all sides, alumium painted ceilings
Rigid insulation	Roof	1-in. thick, under roofing
Acoustic insulation	Office ceiling	

INSTALLED EQUIPMENT

Item	Location	Remarks
Overhead-type doors	Garage	Manually operated
Rolling-type doors	Garage	Steel-shutter type
Street doors	Main plant	Aluminum and glass
Sliding doors	Loading platform	For conveyor openings—fusible linked
Elevator	Main plant	Geared traction, slow speed, 10,000-lb. capacity, manual control
Hose connections	Main plant	For hot and cold water mixture
Drains	Throughout	Provided with clean-out baskets
Sprinkler system	Throughout	Dry type in driveway to prevent damage from freezing
Unit heaters	Main plant	High-pressure steam, reduced to 15 lb.
Convectors	Garage and offices	Low-pressure steam
Electric conduits	In floors	Lighting system
	Exposed	Power system, grid and high tension sources
Lighting fixtures	Ceilings	Incandescent lamps, providing 3 intensities depending on number of rows turned on
Switch control equipment		Magnetic, no-fuse type
Electric signs	Roof	Provision for support made in structural frame
Paint	Ceilings	Except in cold rooms, 2 coats casein or equal
Paint	Garage	Black asphaltum enamel on exposed steel

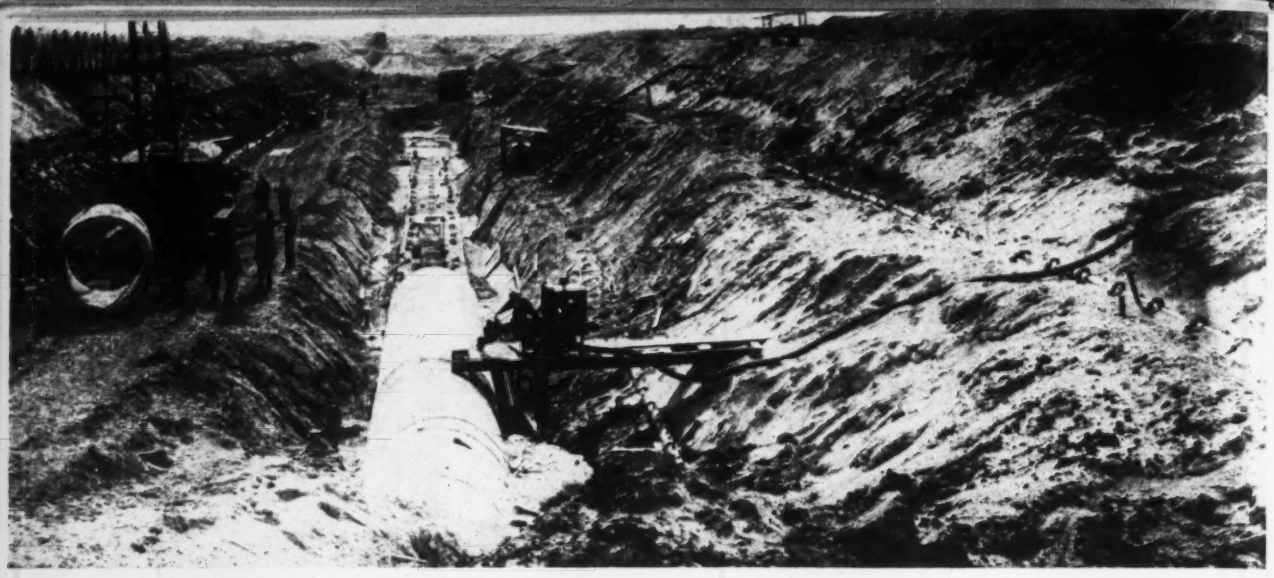

Fig. 1. A sand fill into Jamaica Bay in New York was drained by wellpoints to permit excavation for installing an 84-in. sewer.

Wellpoints in a Pumped-Sand Fill Facilitate Outfall Sewer Construction

***Contents in Brief**—An outfall line into Jamaica Bay, New York City, was constructed by pumping in a hydraulic fill and then draining the fill with wellpoints so that a 1,350-ft. trench could be opened up at one time to a maximum depth of 30 ft. below the surrounding water. About 7,000 ft. of header pipe was required for the wellpoint system, with 18-ft. risers at 2.5 to 5-ft. centers, thus making it one of the largest of such systems ever installed.*

CONSTRUCTION of an outfall sewer across the muddy marginal bottoms of Jamaica Bay, New York, was accomplished recently by an adaptation of the sand-island method used successfully in the past to sink bridge piers through deep mud. For the Jamaica Bay work, a peninsula about 1,400 ft. long was built of dredged sand, and after it had been carried to above highwater level an elaborate system of wellpoints was installed to permit laying the sewer in an open trench that at its outer end was 30 ft. below high tide. By this expedient, expensive sheetpile cofferdams or slow and difficult underwater work were entirely eliminated. All construction was in the dry in open trench.

The outfall sewer is the effluent line from the Jamaica Bay sewage disposal plant of New York City. Its extension for a distance of 1,350 ft. into the bay was made necessary by the construction of New York City's Airport at Idlewild (*ENR* Jan. 24, vol. p. 123) because one of the runways for the airport was laid out across the existing sewer discharge.

The extension had to be built across mud flats lying over ocean sand, the surface of the flats being at about low-tide level. Normal high tide over these flats rises to El. 5, with occasional tides up to El. 8. The hydraulic fill was built to this latter level as an initial operation and higher protective berms thrown up later as part of the trenching operation.

Drainage of the sand peninsula required one of the largest installations

Fig. 2. A test applied after 94 of the 12-ft. lengths of pipe were installed showed no leakage in the line.

of wellpoints ever made, utilizing 7,000 lin. ft. of 8-in. header pipe for four levels. Wellpoint risers were mostly 18 ft. long with 2.5-ft. tips. On the two higher rings, the risers were spaced at 5 ft. centers, but on the two lower or partial rings, Fig. 3, risers were at 2.5-ft. centers. Three 10-in. pumps, nine 8-in. and one 6-in. pump handled 800,000 gal. of water per hour.

The plan followed in digging the trench was to excavate on a 1 to 1 slope with draglines, using the material excavated to raise berms outside to about El. 12 for protection against extreme high water. The sand fill was so soft that to get a start on excavation it was necessary to set a temporary ring of wellpoints at El. 8 to permit movement of equipment to the site and sufficient excavation to start the first-stage wellpoints at El. 0. As the wellpoints at El. 0 started to draw, the ground ahead was drained sufficiently so that the El. 8 header was needed only at the starting end of the project and then only for one week.

The second stage of wellpoints, installed at El. —10, advanced behind the first with their tips extending to El. —31. These lines were adequate for most of the excavation but additional partial rings were required at the outshore end, with their tips at El. —38 to provide a dry bottom at El.—15, more than 30 ft. below high tide. Wellpoints were jetted down to the required depth without difficulty.

Wellpoints set in the boils

Blows and sand boils occurred frequently at the outer end of the trench, which was the deepest part due to the 0.45 percent slope of the sewer, where the outshore end was less protected in deeper surrounding water. At one point, a considerable layer of bay mud just below the low-tide level permitted an inflow *above* the three lower lines of wellpoints.

The means found effective for controlling boils was to add additional wellpoints right in the disturbed area or on the water side of it to "bleed" the water out of the ground far below the surface, stopping movement of sand before it reached dangerous levels or proportions.

Following excavation of the trench, a continuous concrete mat 9 ft. wide and 8 in. thick was laid along the line of the pipe, the concrete being poured directly on the coarse dry sand. Concrete blocks 2 in. thick at the center and wedge-shaped at the sides of the pipe, Fig. 1, were used to position each of the 12-ft. long, 14-ton sections of precast pipe, which were set by a large crawler crane.

The concrete pipe used had walls 8 in. thick in which the reinforcing was positioned to provide maximum

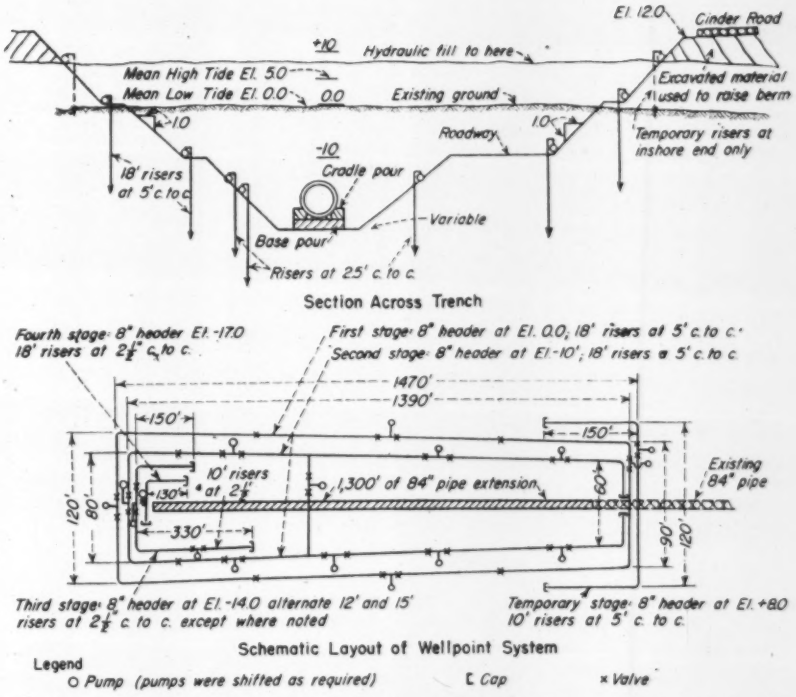
El. 12.0
Cinder Road
+10
Hydraulic fill to here
Mean High Tide El. 5.0
Mean Low Tide El. 0.0
0.0
Existing ground
Excavated material used to raise berm
-10
Roadway
Temporary risers at inshore end only
18' risers at 5' c. to c.
Cradle pour
Variable
Base pour
Risers at 2.5' c. to c.
Section Across Trench
Fourth stage: 8" header El. -17.0 18' risers at 2½' c. to c.
First stage: 8" header at El. 0.0; 18' risers at 5' c. to c.
Second stage: 8" header at El. -10'; 18' risers at 5' c. to c.
1470'
1390'
150'
10' risers at 2½'
1,300' of 84" pipe extension
Existing 84" pipe
330'
120'
90'
Third stage: 8" header at El. -14.0 alternate 12' and 15' risers at 2½' c. to c. except where noted
Temporary stage: 8" header at El. +8.0 10' risers at 5' c. to c.
Schematic Layout of Wellpoint System
Legend
Pump (pumps were shifted as required)
Cap
Valve

Fig. 3. Two complete and three partial rings of wellpoints were used to lower the water 30 ft. in a sand-protected excavation.

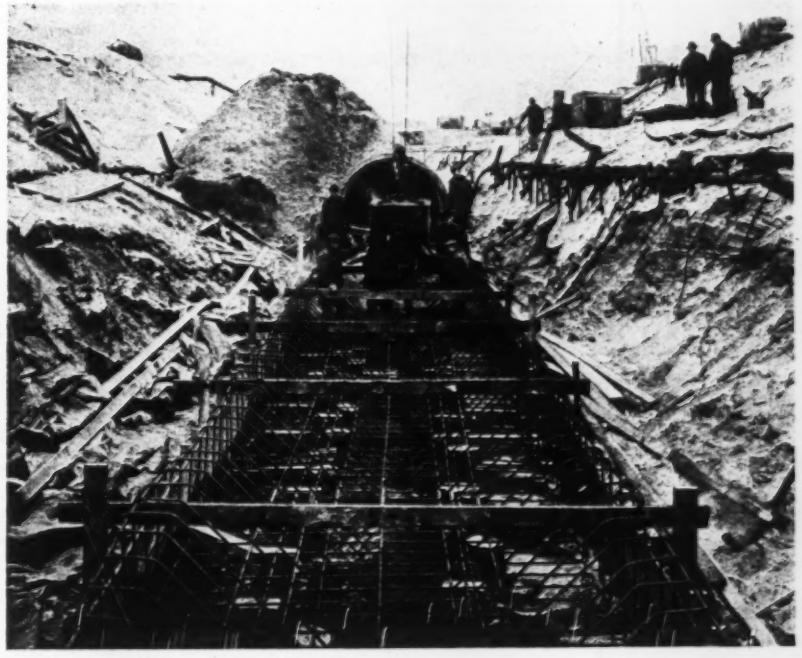

Fig. 4. Alternate vertical and batter piles, visible under the reinforcing, support the outshore end of the sewer outfall.

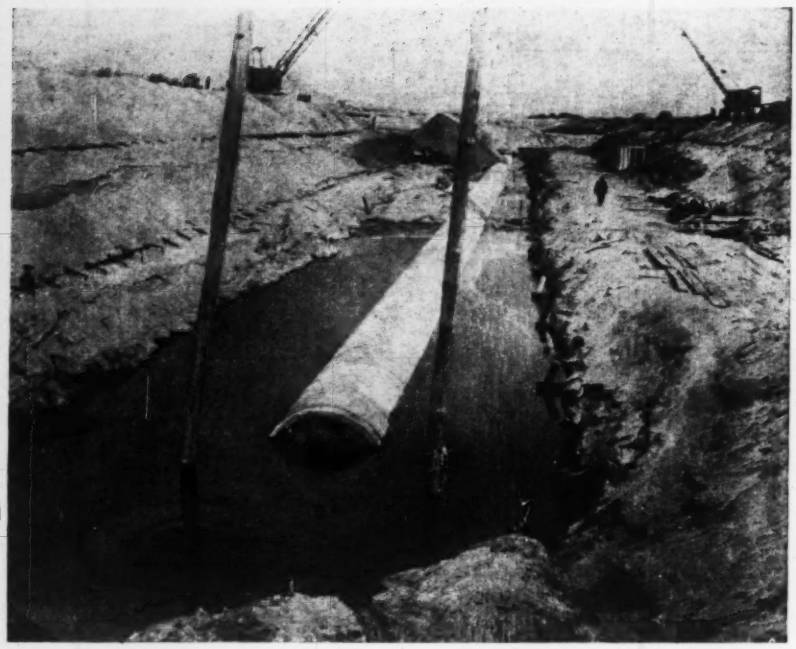

Fig. 5. Completed line ready for backfilling. Note the boil from leakage after the two lower stages of wellpoints have been removed. Piles in the foreground mark the location of the end of the pipe to guide dredging operations to open the outfall.

strength under the anticipated load conditions. To insure correct placing according to this design, the top of each length was clearly marked.

Joints of the pipe have a circular rubber gasket in a protecting ring between the inside and outside lip of the joints. A test on 94 of the 12-ft. sections of pipe showed no leakage.

The outshore 156 ft. of the pipe is supported on creosoted timber piles as the bay has been dredged to a depth of 40 ft. nearby and there is a possibility of undercutting. Piles for the supporting structure were jetted down so their tips were at about El. —46 and then driven about 4 ft. with a double-acting hammer.

There was considerable disturbance to the sand from jetting these piles and several boils resulted. This condition made necessary the installation of the lower partial ring of wellpoints. With this additional deep-drawing suction it was possible to unwater the excavation so that piles could be cut off, reinforcing could be set and concrete placed at 30 ft. below high tide level.

The 84-in. dia. pipe over the pile-supported section is tied down with two $\frac{3}{8}$ in. x 3-in. galvanized straps on each section, anchored into the concrete base.

As soon as the pipe was completed the outshore end was plugged sand-tight, equipment in the trench was removed, starting from the lowest stage, and the trench was backfilled by casting sand in with a dragline and spreading it with a bulldozer. After this work had been completed the berm across the outer end of the outfall sewer was removed by dredge sufficiently to free the end of the pipe, and the plug was withdrawn.

The outfall extension described was made by J. Rich Steers, Inc., of New York, with work directed by John Malcolm, general superintendent, and Harry Weston, job superintendent. Joe Oliva and Jack Almendinger of Complete Machinery & Equipment Co. Inc., assisted in planning the wellpoint system. Atlantic Gulf and Pacific Co. held the general contract for the improvement for the Department of Marine and Aviation of the City of New York. Downer, Green & Carillo are engineers for the city on all of the work on the airport at Idlewild.

Modular Coordination Found Impracticable in Britain

In a second progress report to the British Ministry of Works, dated London, 1946, the Standards Committee, appointed to make recommendations to introduce "the greatest possible measure of standardization" of building materials, stated that complete modular coordination based on a single small module and applied to all building components is not a practicable proposition, nor is it desirable in the interests of economy.

Citing the case of metal sash, the committee said that repetition of a "single light" unit will not give a range of dimensions that will form a regular modular increment. American Standards Association project A 62 attempts to overcome this difficulty by incorporating an extra frame or surround, a practice that the British committee claimed may often prove to be uneconomic.

Also, impossibility of bringing plaster, wall tile, floor and partition thicknesses into a modular scheme was pointed out. For example, says the committee, the varying thicknesses of dampproof causes and flashings will upset the grid planning of an elevation.

The Standards Committee agreed, however, that it is necessary in many types of construction to work on a modular basis, but the unit selected must vary and must be based on the needs of each method of construction. Where a special dimension is not called for by the system of construction, it is recommended that a 3-in. module be used, since it is more likely to fit the general dimensions of manufactured components.

The 3-in. dimension was adopted chiefly because of the influence that brick dimensions had made on existing building sizes in Britain. The English brick is nominally 3x4½x9 in., as compared to the 2⅔x4x8-in. American brick. A 4-in. module was recommended by project A. 62.

Fig. 1. A workable mix and skillful use of first-class equipment gave a smooth riding surface to reconditioned old pavement.

Road Rebuilt with Steam-Dispersed Asphalt

H. J. Ludden
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Buffalo, 2, New York

***Contents in Brief**—Unusual workability of an asphalt mix attained with steam dispersion, plus compaction to exact surface with a three-axle roller made it possible to produce an excellent riding surface over a broken pavement. A semi-portable plant produced 700 tons of material a day, each ton covering about 7 sq. yd. Contract cost, including 4 ft. of widening with concrete prior to surfacing the full 24 ft. width, was about $17,000 per mile.*

WIDENING and resurfacing of a 29-mile section of Route US 20 from the Pennsylvania state line to beyond Fredonia, N. Y., was partly completed last year and has now been finished. Use of the steam dispersion method of atomizing the asphalt resulted in a readily worked mix without use of liquefiers and aided in the production of an excellent riding surface over an old road. The work was done for the New York State Department of Public Works by Warren Bros. Road Co. of Cambridge, Mass.

The original pavement was 18 ft. wide. Later it was widened to 20 ft. and covered with 2 in. of bituminous macadam. The recent project was to widen it to 24 ft. with 4 ft. of concrete 8 in. thick and cover the entire width with 2 in. of bituminous macadam—made up of 1¼ in. binder course and ¾ in. top course.

Macadam was hauled as much as 18 miles from a semi-portable plant set up at Portland, about the center of the project. The plant was built by Warren Bros. and had been used previously by them on hot-mix pavement work. It required only minor changes to adapt it to the steam-dispersion method of preparation of asphalt paving mixes.

Sand was used for the fine aggregate, ¼ in. and smaller; crushed stone was used for all larger sizes. Aggregates came into the plant by rail and were unloaded by crane into stockpiles or directly into hoppers that fed approximately correct proportions of each size material to a bucket conveyor having a capacity of 120 tons per hour for transfer to a rotating drier. The latter, of 110-ton per hour capacity, was 5 ft. dia. and 20 ft. long and was heated by four fuel oil jets.

The several sizes of aggregates were combined in the drier and were han-

CONTENT OF MIXES USED WITH STEAM DISPERSION PROCESS

BINDER COURSE	Passing Screen	Retained on screen	Percent	TOP COURSE	Percent
No. 2 Stone	1 in.	½ in.	53		
No. 1 Stone	½ in.	¼ in.	25	No. 1 Stone	20.3
No. 1A Stone	¼ in.	⅛ in.	9	No. 1A Stone	35.0
No. 1B Stone	⅛ in.	80 mesh	9.25	No. 1B Stone	35.0
				Passing 80 Mesh	4.0
Asphalt Cement			3.75	A C	5.7

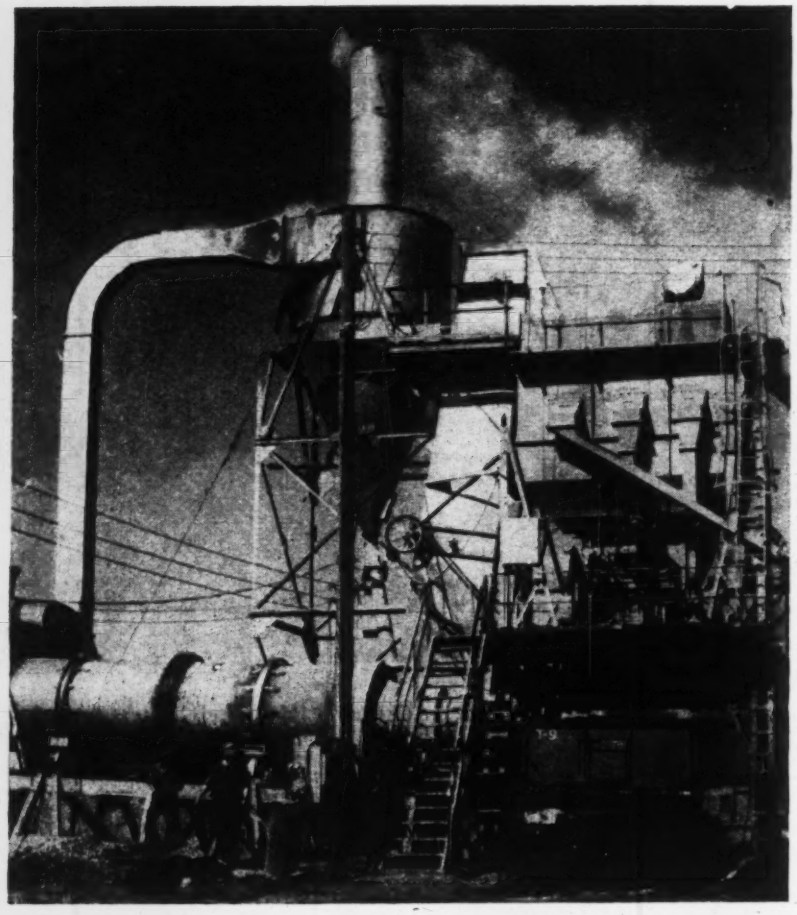


Fig. 2. A semi-portable plant dried aggregates, separated them into four sizes and added steam-dispersed asphalt to make 700 tons of bituminous macadam per day.

dled in this condition to the "hot-stone" elevator, which carried it to separating screens above a four-compartment bin over the batcher and mixer. An electric pyrometer in the discharge chute from the drier recorded the heat of the dried aggregate.

A two and one-half deck 4 x 10 ft. vibrating screen separated the materials into the four sizes shown in the accompanying table. The top screen had 1¼-in. square openings for a 7-ft. length and $\frac{9}{16}$-in. openings for 3½ ft. to separate No. 2 and No. 1 stones. The middle deck, with $\frac{5}{16}$-in. square openings for a length of 7 ft. produced the 1A stone. Originally the bottom deck screen had $\frac{3}{16}$-in. square holes for a length of 6½ ft. but a change to ⅛ x 1½-in. slotted openings increased the capacity. The limiting factor in the plant production was the capacity of the screens.

The bituminous material used was a 100-120 penetration asphalt cement. It came to the job in tank cars where it was heated before being pumped into either of two 8,000-gal. storage tanks. A superheater steam coil in the storage tank permitted heating the asphalt to the required temperature, recorded by an electrical pyrometer, before it was pumped to the mixer.

Asphalt was introduced into a conditioning chamber where it was agitated by dry steam at a pressure of 120 psi. Within a few seconds the steam dispersed the asphalt into finely divided particles after which it was discharged with force upon the aggregates in motion by means of additional steam forcing it through atomizing nozzles.

One-minute mix

Aggregates of each size were weighed cumulatively on a dial scale into the weigh box under the bin. When the total batch was in the box it was dropped into the pug-mill mixer, and the cycle of the time lock was started by dropping of the charge of stone. The dry batch churned in the mixer for a period of 15 sec., and then the operator of the asphalt-steam dispersion unit could put the asphalt into the mix. If there was a delay, the dry mixing continued until the asphalt was introduced. When the asphalt was added, timing of the wet mixing was started and continued for 45 sec., after which the time lock permitted discharge of the batch.

Moderate heat is adequate

Aggregate for the binder course was heated to 240 deg. F., and that for the top course to 270 deg. The asphalt was added at 250 deg. The weight of a batch of binder was 3,500 lb. and that of the top course was 3,250 lb. As a check on batcher weights, the loaded trucks were weighed at the plant on a platform scale. On good days, as much as 800 tons of binder or 600 tons of top course was mixed.

The asphalt mixing plant was operated by a crew of 13 men—a plant foreman, a craneman, an oiler, two mixer men, three firemen, four laborers, and a scaleman.

Trucks ranging in size from 6 ton to 18-ton semi-trailers were used to haul the hot-mix macadam to the road. Lime water was used in the truck bottoms to eliminate sticking. This was

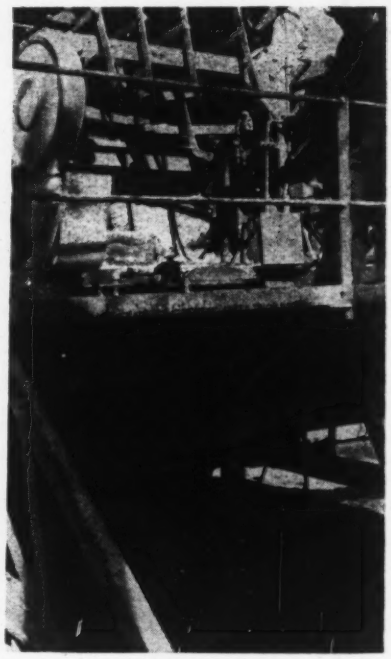


Fig. 3. Materials were weigh-batched, dry-mixed 15 sec., wet-mixed 45 sec., and dumped into truck.

mixed in a 50-gal. drum, using one bag of lime to one drum of water. It was necessary that this material be stirred vigorously before being applied by splashing over the truck bottom. While care was taken not to use excessive amounts of lime water, residue was not drained from the trucks and no harmful effect was observed.

Paved in 12-ft. lanes

The old 20-ft. pavement was widened to 24 ft. by adding to either or both sides of the road as conditions permitted, using about 8 in. of slag-aggregate concrete to bring it flush with the old pavement. The asphalt cover was then placed in two courses on half of the roadway at a time while traffic was maintained over the other side.

Following careful brooming, a binder course was spread with a conventional black-top paver to make a compacted thickness of 1¼ in. No forms were used along the edge of the pavement. Rakers helped to smooth out the surface and keep the outside edges sharp. A 10-ton two-axle tandem roller or 12-ton three-wheel roller was used first to set the material and then a 15-ton three-axle roller was used to assure a plane surface.

Ordinarily, binder material was run for a full day and the ¾-in. top course was placed another day. On the top course, careful checking was done with a straight-edge to assure a true riding surface. The surface could be easily fashioned, however, as the steam-dispersion method atomized the asphalt so that a complete coating of aggregate particles was attained.

Fig. 4. Hot material delivered by semi-trailer is spread 1¼ in. thick for binder course. Where old pavement had settled a levelling course sometimes was used but no primer application was required.

Traffic was turned over the new pavement in a few minutes after rolling was completed, thus minimizing the delay to motorists.

The crew in the field consisted of a foreman, paver operator, five rakers, three roller operators five laborers and two flagmen.

A ton of macadam covered about 6.9 sq. yd. of both binder and top course, including some areas of extra depth. Thus, on good days some 4,800 sq. yd. of paving could be placed.

Warren Bros. Road Co. held a $583,322 contract for the 29 miles of 24 ft. pavement. For the contractor, A. A. Abbott was general superintendent, assisted in 1945 by Raymond L. Holcomb, and, in 1946, by Harry Nowatsky. Paving through the hamlet of Ripley was done by Depew Paving Co. of Depew, N. Y., using materials furnished by Warren Bros.

For the New York State Department of Public Works, the author was engineer on the project in 1945 and now is supervising construction engineer of the Buffalo District, being succeeded at the project by Benjamin Swartz. Charles R. Waters is district engineer.

Overcutting Endangers Minnesota's Lumber Industry

Overcutting of privately owned timber, which has increased steadily since 1941, threatens the already precarious future of Minnesota's lumber industry, Chester L. Wilson, state conservation commissioner, says.

The present abnormal demand created by shortages of building materials results in daily damage to 16,700,000 acres of forest which comprise 40 per cent of Minnesota's supply and contain most of its best lumber, according to E. L. Demmon, director of Lake States Forest Experiment station.

These officials agree that effective control cannot be exercised by the federal and state governments because of the absence of adequate legislation.

Protection of private forests is strictly a voluntary matter, said Wilson. Operators may take advantage of the auxiliary forest law or co-operative agreements, but such action is not required.

Some large companies, such as Minnesota and Ontario Paper Co. and Weyerhaeuser Timber Co., have adopted their own conservation programs. However, the bulk of cutting now is done by small concerns.

Federal figures show that 97.6 per cent of the state's 228,000,000 board feet of lumber last year was produced by concerns handling less than 5,000,000 board feet of lumber each.

Minnesota can derive some satisfaction in not being as badly off as two of its neighbors, Wisconsin and Michigan.

Figures from the Lake States Forest experiment station show Minnesota's annual growth from 1935 to 1944 exceeded annual drain by 60,000,000 board feet.

During the same period Wisconsin was losing 193,000,000 board feet annually and Michigan, 282,000,000.

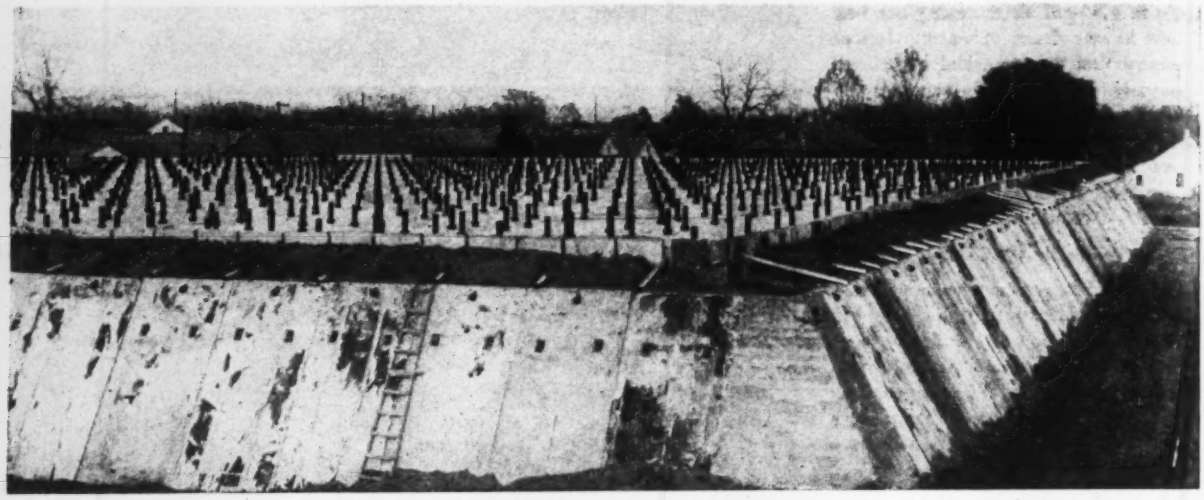


Fig. 1. Clearwater storage reservoir with 7,000,000-gal. capacity has roof and walls of precast concrete slabs.

Precast Sectional Walls and Roof Allow for Uneven Reservoir Settlement

***Contents in Brief**—Articulated design utilizing precast concrete slabs for the walls and roof is expected to reduce cracking in a new 7,000,000-gal. rectangular reservoir constructed on the unstable soil of New Orleans, La. Reservoir walls are made up of slabs with tongue and groove joints, and similar slabs form the sloped outer wall of an earthfill cofferdam surrounding the storage basin. The roof consists of precast units, each supported independently by pin suspension on cast-iron pipe columns, with V-joints between the slabs.*

IN AN EFFORT to control cracking of concrete walls and roof of a water reservoir, the New Orleans Sewerage and Water Board has built for its Algiers service, across the Mississippi from the main part of the city, a 7,000,000-gal. clearwater covered storage basin incorporating relatively thin precast slabs in both walls and roof. For sealing leakage and incidentally furnishing some resistance to hydrostatic pressure, the vertical walls are surrounded by an earthfill cofferdam which has a sloped outer wall likewise constructed of precast slabs. Maximum water depth in the reservoir is 13 ft. The entire structure rests on earth; no piles are used under any part of it.

Rectangular in plan, the reservoir measures 309 ft. 3 in. by 383 ft. 6 in. inside the vertical walls. Interior clear height varies from 14 ft. to 13½ ft. under a roof which slopes 6 in. in 155 ft. both ways from a center ridge.

All reservoir wall slabs, as well as the so-called levee slabs for the outer face of the cofferdam, have tongue and groove round-nose joints. The joints between the roof slabs are V-type, filled with pitch.

For the reservoir roof, the design employs a checkerboard of independent precast slabs, roughly 13x13 ft. square, each supported (or, more properly, suspended) on four cast-iron pipe columns, which project a short distance above the roof level through cast-iron sleeves in the slabs. The columns rest on the reinforced-concrete floor of the

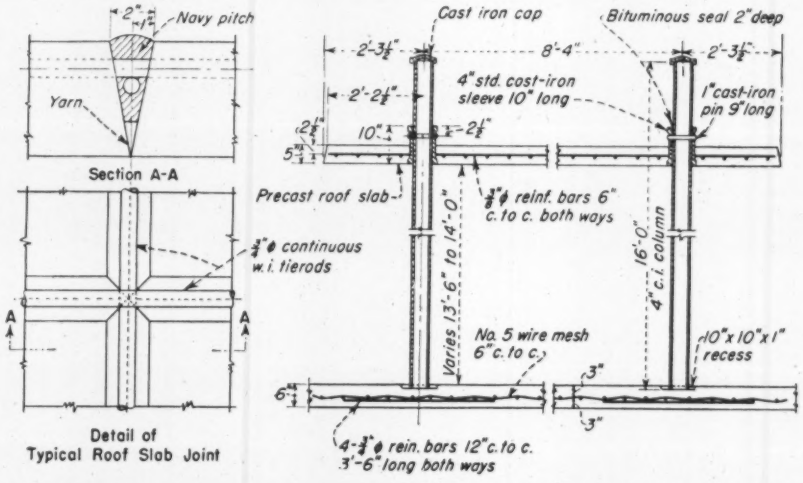


Fig. 2. Each precast roof slab is independently supported by pin connections to four cast-iron pipe columns extending upward through cast-iron sleeves in roof unit.

reservoir, which was paved in 20-ft. lanes by conventional methods. No dowels or tongue and groove joints are used between roof slabs.

Opposite walls of the reservoir are tied together at the roof line by continuous wrought-iron tierods embedded in pitch in the V-joints. These tierods extend in both directions across the top of the structure. Outer walls of the earthfill cofferdam likewise are tied, near their tops, by steel rods to the inner reservoir walls. At the bottom of the reservoir, the reinforced-concrete floor slab furnishes a continuous tie in both directions between the walls.

General conditions

New Orleans topography, with a maximum variation in elevation of 17 ft., provides no natural sites for elevated reservoirs. All stored water is pumped to the reservoirs and from the reservoirs into the municipal distribution system.

In general, the natural soil of the city on both the east and west banks of the Mississippi has a top layer 5 or 6 ft. thick of organic matter, humus and clay overlying a thick layer of fine sand, which may extend 30 or 40 ft. to mixed strata of clayey and silty character. Groundwater is encountered at shallow depths, normally not more than 5 ft. below the surface. No stable bearing material can be reached at any feasible depth. Piles driven to clay represent the usual method of supporting heavy loads in this area.

Reservoirs previously constructed with heavy monolithic walls have suffered from the poor foundation conditions, whether supported on piles or on earth. With both types of foundations, non-uniform settlement has resulted in cracks.

In planning the Algiers reservoir, use of piles was ruled out for two reasons, according to the designer. First, placing the reservoir on earth minimizes the possibility of voids, which always are found under structures supported on piles. Second, elimination of piling permits uniform settlement of the reservoir with the cofferdam and gives greater assurance that the bottom and walls of the reservoir will remain in contact with the earth subgrade and the cofferdam fill, which serves as a sealing medium against leakage through the cracks inevitable in a structure of this extent.

Walls of the reservoir are made up

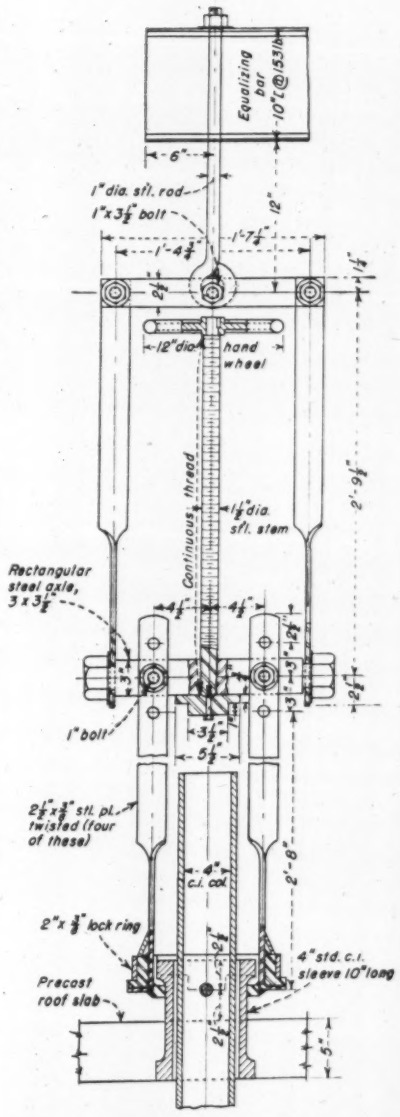


Fig. 3. For placing roof slab over columns, adjustable clamps are suspended by steel-plate slings from four points on equalizing rig picked up by crane. After roof slab has been lowered over column, screw jack operating through threaded hole in rectangular steel axle transfers load to pipe column, allowing release of slings suspended from equalizing bar.

of a total of 184 reinforced-concrete slabs. Of this number, 174 are precast units, and 10 are cast in place. Cast-in-place slabs include four units at the corners of the reservoir and six at the location of two reservoir inlets. All of the units have an effective width of 6 ft. 5 in. Precast units measure 15 ft. 8½ in. in height by 6 ft. 5 in. wide.

Tops of the wall slabs are at a uniform level 15 ft. 2½ in. above the floor of the reservoir. They project above the pitched roof varying distances, from 1 ft. 3½ in. to 9½ in.

Wall slabs are thickened at the base to furnish greater bearing area on the tamped and rolled earth grade. The outside face of the slabs is vertical. They are 6 in. thick at the top; a slight batter on the inner face increases this thickness to 7½ in. at a point 7 ft. above the reservoir floor. Below this point, the thickness remains uniform down to a 45-deg. fillet, originating 1½ ft. above floor elevation and 2 ft. above bottom of the slab. This fillet widens the base to 2 ft. 1½ in.

Cast-in-place wall slabs at the two inlets have footings which go down to greater depth as required by adjacent sumps with bottom elevation 3 ft. below the reservoir floor. At each location, a 20-in. cast-iron intake and discharge pipe passes through the wall footing.

One edge of each wall slab has a round-nose tongue 1¾ in. thick by 2⅝ in. high; the opposite edge has a round-nose groove 2¼ in. wide by 2⅝ in. deep. Slabs were set with a ½-in. joint opening between facing edges. In the vertical reservoir wall, the joints are filled with bituminous mastic sealing compound, poured in three lifts with the aid of jute and clay as a temporary form to hold the hot liquid.

Wall slabs and sections

Levee slabs forming the sloped outer wall of the earthfill cofferdam are likewise tongue-and-groove units, with tongues and grooves slightly smaller than for the slabs in the reservoir wall. Joint openings ½ in. wide were left unfilled for drainage. The outer wall required 188 precast slabs 17½ ft. long by 6 ft. 5 in. wide by 5 in. thick. Four corner sections were cast in place. The levee wall inclines at an angle of 60 deg. with the horizontal, and all levee slabs extend about 4½ ft. into an earthfill toe, to take any earth thrust the wall may be called upon to resist.

Wall slabs and levee slabs are reinforced with two layers of steel. In the 6-in. floor slabs and the 5-in. roof slabs, the designers considered it impractical to install more than one layer of steel. Because these slabs are

subjected to positive as well as negative bending moments, the single layer of steel is placed in the middle of the slab.

Floor and roof details

Floor slab 6 in. thick, reinforced with 6-in. mesh of No. 5 wire, was placed with a paving mixer on tamped and rolled grade in 20-ft. lanes, with keyed construction joints between them. Pipe columns supporting the roof slabs were set in depressions 1 in. deep in the concrete floor, later filled with grout. No flanges were used at the bases of the pipe columns. At each column location, the floor slab has additional reinforcement of eight $\frac{3}{4}$-in. round steel bars $3\frac{1}{2}$ ft. long, four each way, on 12-in. centers.

Each roof slab, 12 ft. 11 in. square, is supported by four 4-in. cast-iron pipe columns. Reinforcement in the roof slab consists of $\frac{3}{8}$-in. round bars 12 ft. 9 in. long on 6-in. centers both ways.

Cast in each roof slab are four standard 4-in. cast-iron sleeves 10 in. long, spaced 8 ft. 4 in. c. to c. in both directions. Pipe columns 16 ft. long project upward through these sleeves, and the slab is suspended at each column by a 1-in. cast-iron pin inserted through matched holes in the sleeve and the column. Holes in the pipe column were drilled during the final stage of erection, after the slab had been adjusted to grade.

This design, using projecting columns, permits future adjustment of roof slabs if any uneven subsidence of the structure should result in ponding of rainwater on the roof, which might cause contamination of drinking water inside the reservoir.

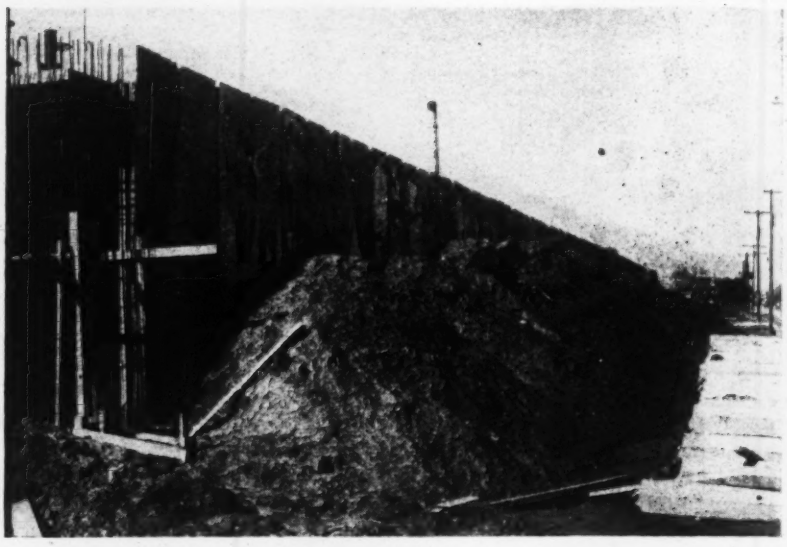


Fig. 5. Precast slabs for reservoir wall are set by crane in permanent position on compacted earth grade before cast-in-place corner section is constructed. Prior to setting precast slabs for sloped outer wall of cofferdam, contractor places portion of river-sand fill against reservoir wall.

Concrete for the reservoir construction consisted in general of standard portland cement, sand and gravel in weighed proportions to produce 3,000-lb. minimum strength at 28 days. Saturated burlap or ponding with water was used for seven days' curing required on this concrete. In a few instances the contractor was permitted to use high-early-strength cement to speed the work. Truck mixers delivered concrete for the wall and roof units from a batching plant set up on the site.

All sectional units for the roof and walls were cast on the floor slab, used as a bottom form, with steel forms for the edges. The contractor used building paper on the floor slab to keep the concrete from sticking. Mechanical vibrators and hand puddling consolidated the concrete in the forms to eliminate honeycomb.

Raising roof slabs

Unusual apparatus was designed for erecting the roof units and adjusting them to the desired elevation. Four pipe columns to support each roof slab were set up in the 1-in. depressions in the concrete floor and were held in vertical position by a portable rectangular scaffold equipped with special pipe clamps at its four corners. Using an equalizing rig equipped with adjustable clamps, which grasped the four cast-iron sleeves protruding above the top of the roof slab, a crane picked up the $5\frac{1}{2}$-ton precast unit and lowered it over the columns. In this position, the load was taken up on built-in screw jacks included in the adjustable clamping units, and the slings then were detached, allowing the equalizing rig to be used for picking up the next unit.

Made up of 10-in. steel channels in the form of the letter H, the main frame of the equalizing rig was designed with single bolt connections which permitted the bars of the H to

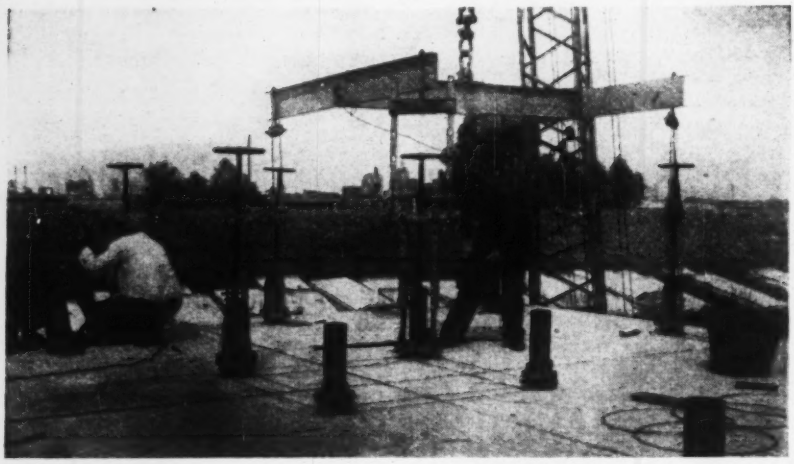


Fig. 4. Equalizing rig with adjustable clamping devices enables crane to raise roof slab from ground and lower it over four pipe columns. In this position, load is transferred to columns by screw jacks in adjustable clamping units.

Fig. 6. Levee slabs for outer wall of cofferdam are set in sloped toe trench, backfilled with earth, and are braced and tied at top to reservoir wall. Struts remain in place until fill shrinkage has been completed and material has been built up to final elevation.

rotate and thus distribute the load uniformly among the four pick-up points. Fig. 4 shows the apparatus in use. Near the end of the two side bars of the H were hung steel-plate slings, each of them equipped with two hanger pieces to which an adjustable clamping unit was attached.

A rectangular steel axle forms the backbone of the adjustable clamping unit. Fig. 3 illustrates the details of the device. Four steel-plate hangers were suspended from the steel axle. At the lower end of each hanger was a welded shoulder, and these shoulders on the four hangers were locked under the upper flange of the cast-iron sleeve by means of a locking ring to enable the lifting apparatus to pick up a precast slab.

When a slab had been lowered over the pipe columns, the load at each of the four slings was transferred to the column by means of a screw jack operating through a threaded hole in the center of the rectangular axle. Attached by a machine bolt to the lower end of the threaded stem of the jacking screw was a machined steel seat which fitted the top of the pipe column. By turning a wheel at the top of the jacking screw until the load was taken up on the axle of the adjustable clamping device, the weight of the slab was transferred at each point of support to the pipe column. The screw jack then could be used to adjust the elevation of the slab at each pipe post.

Cast-iron sleeves fitting over the pipe posts previously had been drilled with holes to admit the 1-in. cast-iron pins on which the roof slab eventually was supported. When the slab had been adjusted by means of the screw jacks to final grade, workmen drilled matching holes through the pipe columns with an electric drill. The 1-in. pins then were inserted through the holes, and the load was taken on these pins by releasing the screw jacks. After the slab had been suspended in this way on its permanent pin supports, the bottoms of the pipe columns were grouted in place by filling the 1-in. depressions in the floor slab with cement grout. The top of each column is covered by a permanent cast-iron cap, and the opening around the column at the sleeve is filled 2 in. deep with bituminous sealing compound.

Erection of walls

At the top of each wall slab, two 2-in. pipe nipples were cast in the concrete and were later removed to provide threaded holes for screwing in eyebolts. Using a bridle hooked to the eyebolts, a crane picked up the wall slabs, weighing 5½ tons each, and set them on compacted subgrade. Sections at the four corners and at the two inlets were cast in place after the precast wall units had been lined up in permanent position. With the pre-

Fig. 7. The corner sections of the protective slab were cast in place. Runoff from the roof is carried over the earth fill in the drains shown and the lifting holes in the precast slabs are left open to act as weepholes.

cast wall slabs in place, a closing strip of floor concrete was put down between the toe of the wall slabs and the previously paved floor slab.

Levee slabs, weighing about 3½ tons each, were equipped with lifting rods cast in the concrete across permanent weep holes, four to a slab. A crane lifted each slab with two bridles of the proper length to hold the slab at an angle of about 60 deg. with the horizontal. Prior to placing the levee slabs, a portion of the cofferdam fill was placed, and a sloped trench was excavated at the toe of the fill to receive the bottoms of the slabs.

Before any fill material was deposited in the cofferdam area, the existing ground surface was plowed, and a 3x2-ft. key trench was excavated. The fill material is river sand obtained nearby. After completion of the cofferdam wall, fill material was placed inside to a height of 12½ ft. About 2 ft. of shrinkage is expected in this fill. After shrinkage, the fill will be built up to the top of the wall, covering part of the steel tierods which tie the levee wall to the reservoir wall.

No roof cover is provided over the cofferdam fill. Rainwater from the roof of the reservoir is carried over the fill in galvanized metal spouts to the outside of the levee wall. Natural drainage is relied upon to take care of any rainwater which penetrates the fill. Each levee slab section contains four weep holes. In addition, as already noted, the ½-in. tongue and groove joints between slabs are left open. As a further precaution against saturation, a 10-in. open-joint subsurface drain of concrete bell-and-spigot pipe has been installed outside the cofferdam around the four sides of the reservoir.

Struts and ties

Corner units of the levee wall were constructed with cast-in-place concrete after precast slabs had been set adjacent to the corners. At the top of each levee slab, a 4x4-in. timber strut was placed between the slab and the reservoir wall, and a 1-in. steel tierod was installed between the outer slab and the top of the reservoir wall. This rod, threaded for nuts at both ends, passes through a 1½-in. nipple in the levee slab and a slot in the top of the reservoir wall. At the four corners, longer tierods extend inward beyond the reservoir wall to steel angle anchorages embedded in the roof slab.

Across the top of the roof, continuous ¾-in. wrought-iron tierods were placed in the V-joints between roof slabs, 12 ft. 11 in. c. to c. These rods were lapped 4 in. and welded at each splice.

Calkers closed the bottoms of the roof V-joints, 2 in. wide at the top and 5 in. deep, with yarn before the continuous wrought-iron rods were installed. A sealing crew later covered the rods by filling the V-joints with pitch. A small working stress was introduced in the rods by tightening nuts at the ends to develop 1,000-lb. tension in each, thus making them immediately effective in tying the opposing walls of the reservoir together.

In conditioning the reservoir for service, it is planned to fill it gradually with water. The time of filling will extend over a period of months to allow the cofferdam fill to become completely compacted.

Direction

All design, construction and operating functions of the New Orleans Sewerage and Water Board are under the direction of A. B. Wood, general superintendent. Albert E. Marks, mechanical engineer, was in charge of the design of the Algiers clearwater reservoir, and S. Finkelstein, civil engineer, supervised construction.

The reservoir was built by Boh Bros. Construction Co., New Orleans contractor, on a lump sum bid for nearly $160,000.

Several Cities Complete Master Plans for Long-range Development

Chicago's new master plan calling for development of many small "cities within a city" marks the latest addition to the roster of municipalities recently providing for long-range urban redevelopment based on comprehensive planning.

The American Society of Planning Officials reports that Richmond, Va., and Lancaster, Pa., also have recently completed master plans, and observes that master-planning is not restricted to vast metropolitan areas as a means of helping solve housing, traffic, public works and other problems intensified by reconversion congestion.

The Chicago plan will be presented to the people in a graphic publication showing how residential, commercial and industrial land may be used most advantageously to sustain the 59 "cities within a city," each with a population of 50,000 or more. The plan prescribes further subdivisions of the huge city (nearly 3,500,000 pop.) into 514 distinct neighborhoods each containing a grade school, a park and a playground.

If the plan is followed each of the 59 communities in the Chicago of the future will include a high school, a large park and athletic field, a major shopping center and other facilities not available in every neighborhood. The communities will be separated by industrial belts, transportation arteries, or parks. In specified areas heavy industries are segregated by the plan.

There would be cooperation between Chicago and adjacent communities in both Illinois and Indiana on drainage, highway and recreation projects. Although some specific planning problems are yet to be solved, the master plan is being released now because a number of the projects it proposes are slated for construction in the near future. Bond issues authorized by Chicago voters June 3 will finance several such projects, including superhighways.

The total estimated expenditure necessary to fulfill the Chicago master plan has not been published to date. The plan for Lancaster, Pa. (61,345 pop.) calls for expenditure of $13,000,000 on integrated community projects between 1947 and 1952 and an additional $18,000,000 during the next two decades. The Richmond, Va. (208,039 pop.) plan includes specifications for projects costing an estimated $130,000,000 during the next 35 years.

The Cincinnati master plan, as yet unfinished, is an exceptional example of efforts by planners to incorporate in a single design for orderly growth and rehabilitation the urban futures of the several municipalities in a large metropolitan area. Development in four counties located in two states—Ohio and Kentucky—is being integrated in the Cincinnati master plan.

Access Rights Legislation Required for Freeway Construction

J. M. Devers
Chief Counsel, Oregon State Highway Commission

***Editor's Note**—The accompanying article is an abstract from a paper presented by Mr. Devers at the recent Salt Lake City meeting of the Western Association of State Highway officials.*

TRANSPORTATION by motor vehicle, whether by private car, bus or truck, calls for highways constructed and operated under conditions that permit and insure control of access—access to and from abutting land and access from and over bisecting or intersecting highways. To make such controls possible, the public must acquire more complete and more exclusive interest in properties dedicated for right-of-way purposes, and greater freedom in highway designing must be assured. A highway department is now denied the right to design, construct, maintain and operate a type of highway that public welfare demands, merely because of property rights retained by the abutting owner and withheld from the public.

What are these property rights that the abutting owner retains? They are incidents of ownership or occupancy of land. They are created the moment the public acquires a right-of-way and builds a highway.

Access rights defined

A California court has defined these vested rights by saying, "An abutting owner has two kinds of rights in a highway, a public right which he enjoys in common with all other citizens, and certain private rights which arise from his ownership of property contiguous to the highway, and which are not common to the public generally . . ." The court further stated that this latter type of property right cannot be damaged or taken away from him without due compensation. The court also stated that the owner of property abutting on a public highway has an easement of reasonable view of his property from the highway.

In my opinion the California court is too sweeping in its definition and declaration of those rights. However, the major conflict between owner and the public is not so much with respect to ordinary ingress and egress. The real conflict is with the owner's contention and claimed right to have highway traffic leave the highway to become his patron and his customer, and then return again to the highway even to the inconvenience and hazard to other highway users.

As an illustration of the conflict that prevails with respect to ribbon development we may cite the incident of a four-lane highway construction by the Oregon State Highway Commission through territory which to a large extent was fields, gardens or pasture but which rapidly developed following the construction of a highway. The result was that of 10,000 motor vehicles which operate over the road during a given period, approximately 400 find occasion to patronize activities along the highway to the detriment, inconvenience and, in some instances, hazard of the remaining 9,600 motor vehicle operators who are not interested in hot dog stands or other commercial use of that particular road.

An abutting owner's entire vested right in a public highway may for all purposes be transferred to and vested in the public pursuant to law and by the payment of just compensation. However, to accomplish that result, it is necessary that highway officials be clothed with proper authority.

Vested with such power or authority, the only question or issue open for discussion between the property owner and public officials is the amount that the public is willing to or must pay for what the owner now has and the public needs.

It would prove expensive were we to convert to a through or arterial highway one which now is in existence and which serves both local and through traffic. Modernization of highways must therefore apply largely to new or relocated highways. Several methods have been proposed for the accomplishment of control of access. These proposed methods include zoning, roadside development, land-use control and marginal land acquisition. In my opinion the simplest and most satisfactory method is a method by which the abutting owner's rights in the highway are all transferred to and vested in the public. We must concede that the passage or enactment of through-highway legislation is dependent largely on public opinion. However, a well-informed public can be depended upon to reach correct long-range decisions.

Right-of-way costs will in any event prove expensive. These excessive costs are due to several conditions and developments:

1. Real property in every state has greatly advanced in price.
2. Areas through which arterial highways are located are usually highly developed and well improved.
3. Through or arterial highways call for unusually wide rights-of-way.
4. Restrictions with respect to use and requirements by which easements of access are lost to the abutting owner make acquisition by agreement or the exercise of eminent domain difficult and expensive.

Right-of-way costs

A right-of-way buyer, who may be assigned the job of procuring necessary rights-of-way for the control of a through or arterial highway, will find himself confronted with demands by the owner that compensation be made for these things:.

1. Value of land taken.
2. Damage to land remaining.
3. Loss of right of access to the highway.
4. Loss of right to have highway traffic patronize his commercial activities.

Controls, under zoning legislation, roadside development, land-use controls and marginal land acquisitions, all contribute and lend themselves to a highway design beneficial to the general public, but, unless the owner's easement of access is taken from the owner and vested in the public, the type of highway which traffic now demands will not be possible.

We must all recognize and concede the rights of an abutting owner. All must likewise recognize and concede the rights of the public. We must concede, too, that the rights and welfare of the public are paramount.

Building an Airbase in the Azores

Brig. Gen. J. S. Bragdon
Director of Military Construction, Office of the Chief of Engineers

***Contents in Brief**—On Santa Maria island in the Azores U.S. Army Engineers have built an airbase destined to be as useful in peace as in war. Now used as a trans-Atlantic stop, it required 3,000,000 yd. of excavation in volcanic rock and the production of 440,000 yd. of crusher run material. Asphaltic and tar runways on stone base courses were designed for 60,000 lb. wheel loads. Paved parking areas will accommodate 81 large transport planes.*

AN AIRBASE of the Army Transport Command with one of the most promising futures in commercial aviation of any of those built by U. S. Army Engineers is that at Santa Maria in the Azores, where runways of 8,000 4,600 and 6,000 ft. and a paved parking and maintenance apron of 462,000 sq. yd. are provided. Its construction, completed in early 1945, involved a number of engineering problems peculiarly its own, in addition to those usually characteristic of advanced base building.

The Azores lie about 1,500 miles equidistant from the coast of France, Newfoundland, and England, and, consequently, form a natural crossroads for the southern trans-Atlantic air routes. Moreover, a considerable amount of northern route traffic is switched Azores-way because of bad weather. A smaller, Portugese-British-built base known as Lagens Field, and located on the island of Terceira, was used as a transport and bomber patrol base prior to the completion of the Santa Maria facilities, and earlier than that, and even prior to the war, the flying boats of Pan American Airways were serviced in the harbor at Horta. There is thus ample evidence of the usefulness of the Azores as a trans-Atlantic stopping point.

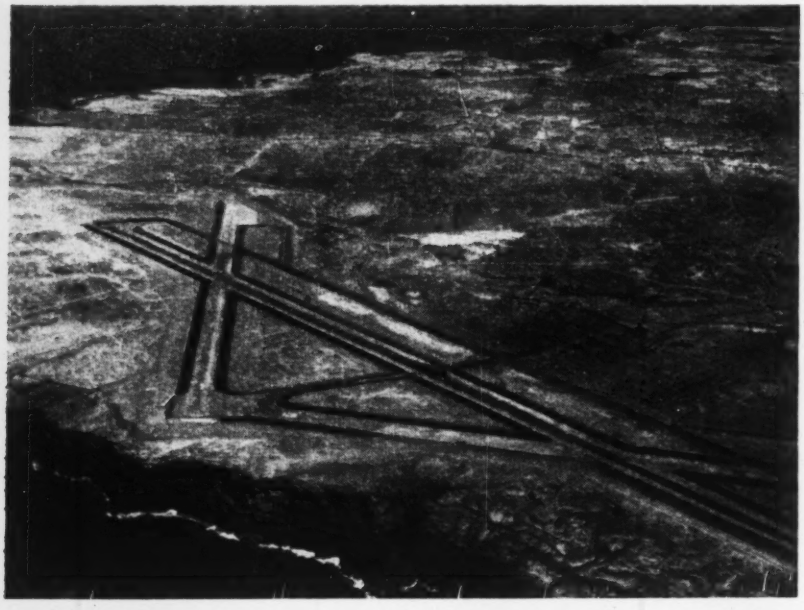


Fig. 1. Santa Maria airfield is atop a cliff on southeasternmost island of the Azores. North-south runway is 8,000 ft. long.

Santa Maria is the southeasternmost island in the Azores group and covers an area approximately 6 x 8 miles. It rises steeply from tree-lined shores to a rolling plateau on its western side and to peaks ranging from 1,700 to 1,900 ft. on the east. Though free of eruptions, it is of volcanic origin, with shallow clay soil and numerous igneous outcroppings. It climate is temperate, with prevailing north and northwest winds and an average yearly rainfall of 27 in.

The island's native population is only 8,000. There are no cities, industries or military installations of any consequence. The only harbor consists of 270 ft. of rocky beach plus a small masonry dock at the town of Vila do Porto. Ship-to-shore unloading was required for any vessel over 90 ft. in length and of more than 7-ft. draft. The island had no electricity, almost no running water, no mechanical equipment and no transportation except by donkey and oxcart.

A survey party headed by the author landed by plane on Santa Maria Aug. 8, 1944. A group of 25 officers and men under Brig. Gen. A. D. Smith, commanding general of USAF in the Azores, had arrived by boat four days before and supervised the clearing of a landing strip about 2,500 ft. long.

The site selected for the location of the permanent runways was approximately 300 ft. above the sea and on semi-rough terrain, with rock fences three to four ft. high dividing the area into small parcels of land. Initial engineering studies located quarry sites for rock and stone, sources of water supply (wells at the base of the mountains) and a road route from the harbor area to the airfield site.

Construction of the first permanent runway began Sept. 25, 1944. The rock and clay encountered on the runway site made trenching and grading operations extremely costly. Groundwater elevation varied considerably

Fig. 2. Huge parking apron, 462,000 sq. yd. in extent distinguishes Santa Mairia field from the air. Operational buildings and the hangar are at the left.

and, in a number of cases, groundwater was at the surface. No pervious, self-draining soil was encountered.

In order to provide a runway suitable for immediate use, 4 in. of disintegrated volcanic rock was placed on the only available location, in the southerly portion of the airfield reservation. This temporary runway, 3,000 ft. in length, was suitable for landing light planes in dry weather only.

Later 4,500 ft. of pierced plank was built on the south end of the north-south runway. Of this amount, about 2,000 ft. extended into the permanent north-south runway proper. This portion was constructed to the necessary longitudinal and transverse grades required, and it was necessary only to remove the steel mat and cover the subgrade with stone base and asphaltic concrete to convert it into the permanent runway.

The north-south runway of 8,000 ft. is intersected at its quarter points by the northeast-southwest runway of 4,682 ft. and the northwest-southeast runway of 6,159 ft., and these in turn intersect at their westerly ends. The runway layout conforms to both wind rose and ground pattern.

Minimum taxiways provide good traffic circulation and connect all runways to the paved parking and maintenance apron, which can accommodate storage of 81 C-54 type planes. Warm-up pads are provided at the juncture of taxiways with the runways. Operational and maintenance facilities are located immediately adjacent to the parking apron.

Since the north-south runway was most suited for instrument landings, the pavement was constructed to a with of 200 ft. Runway shoulders are 75 ft. wide. A graded area 75 ft. wide was constructed adjacent to the shoulders. The developed cross-sectional width from ditch line to ditch line is 500 ft. Cuts and fills were constructed to a side slope of 10 to 1 at the beginning, but later changed to 5 to 1 in order to reduce graded quantities. The northeast-southwest and northwest-southeast runways were constructed to the same cross section, except that the pavement area was made 150 ft. wide and the graded area adjacent to shoulders 100 ft. in width.

Taxiways were paved to a width of 50 ft., with 25-ft. shoulders and 55-ft. graded areas. Runways and taxiways were constructed to a traverse grade of 1 percent for paved and shoulder areas and 1½ percent for graded areas. Crown sections were not used except for a portion of taxiway having a crown center line. This method was chosen as best for adapting runways and taxiways to existing terrain and reducing grading.

The maximum longitudinal grade does not exceed 0.65 percent on run-

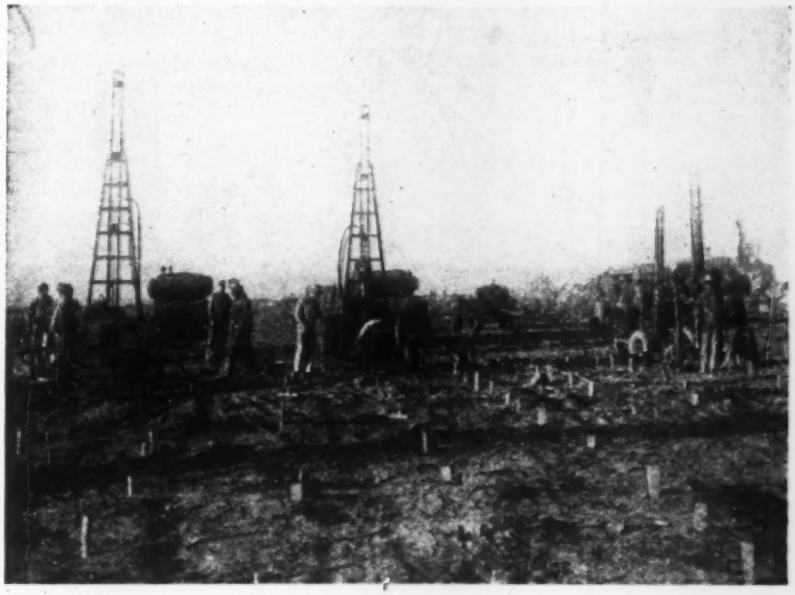


Fig. 3. Wagon drills were used extensively in connection with runway blasting and grading of the volcanic material. Some 2,000,000 yd. of material was excavated in constructing the runways.

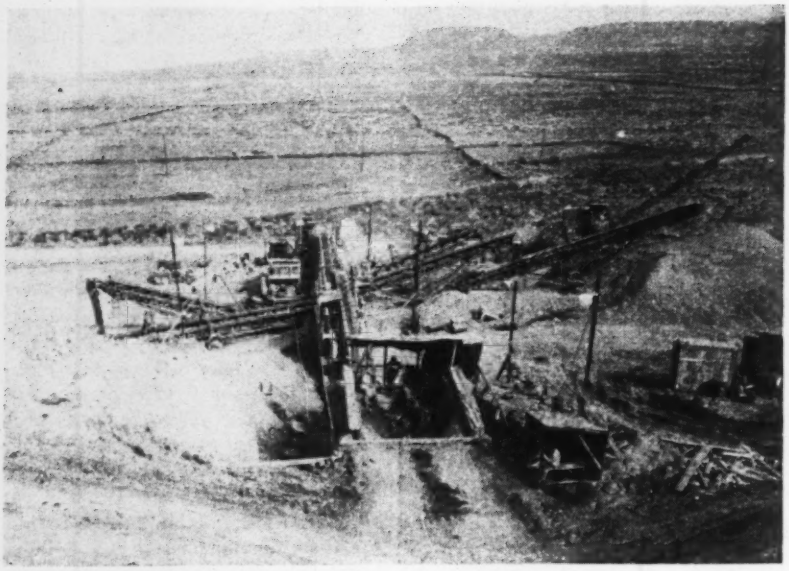


Fig. 4. One of the two 100-ton per hr. crushing plants, which together produced 285,000 yd. of base material and 159,000 yd. of aggregate. In the background is the typical island terrain marked off by stone fences, much of the rock from which found its way to the crushers.

ways, 2 percent on taxiways, and 1.8 percent on the parking apron. Grades and sight distances were controlled to a large extent by the existing terrain. In the case of the north-south runway, the plan location was governed by the only satisfactory spot for the radio range station. This particular alignment restriction prevented compliance with standard sight distance, but the using service consented to establishment of a sight distance of 5,000 ft. between any two points 10 ft. above the runway.

A clear zone 1,000 ft. long was constructed at the north end of the north-south runway, and an area 1,000 ft. long was smoothed at the southeast end of the northeast-southwest runway. The south end of the north-south runway is suitable as a clear zone due to the existence of the temporary runway previously described. Existing terrain precluded the construction of clear zones in all other cases. No obstacles, natural or artificial, high enough to obstruct a 40 to 1 glide angle exist in the approach zones to the runways.

Runways, taxiways, and apron are designed for planes of 120,000-lb. gross load, or 60,000-lb. wheel load. The California "bearing-ratio method" was used for evaluating subgrades and base course materials, and for determining required thickness of base. California bearing ratio field control tests were made all during construction operations. The required total compacted thickness of base and pavement was 30 in. on earth embankments. The combined thickness in the case of rock fill embankments was 15 in. Where the subgrade was of solid rock, 9 in. total combined thickness was used. In all cases, a minimum of 6 in. of crushed rock was used under paved areas.

Runway shoulders were constructed to the same design criteria except that disintegrated rock was used in lieu of crushed stone for the upper base course, and a dust palliative provided in lieu of pavement. Graded areas adjacent to shoulders were not constructed to withstand design loads; however, embankments were built in accordance with good engineering practice.

Runways and taxiways were paved with hot mix asphaltic concrete 3 in. thick, made up of a 1½-in. binder course and a 1½-in. wearing surface. The surface then was sandsealed with

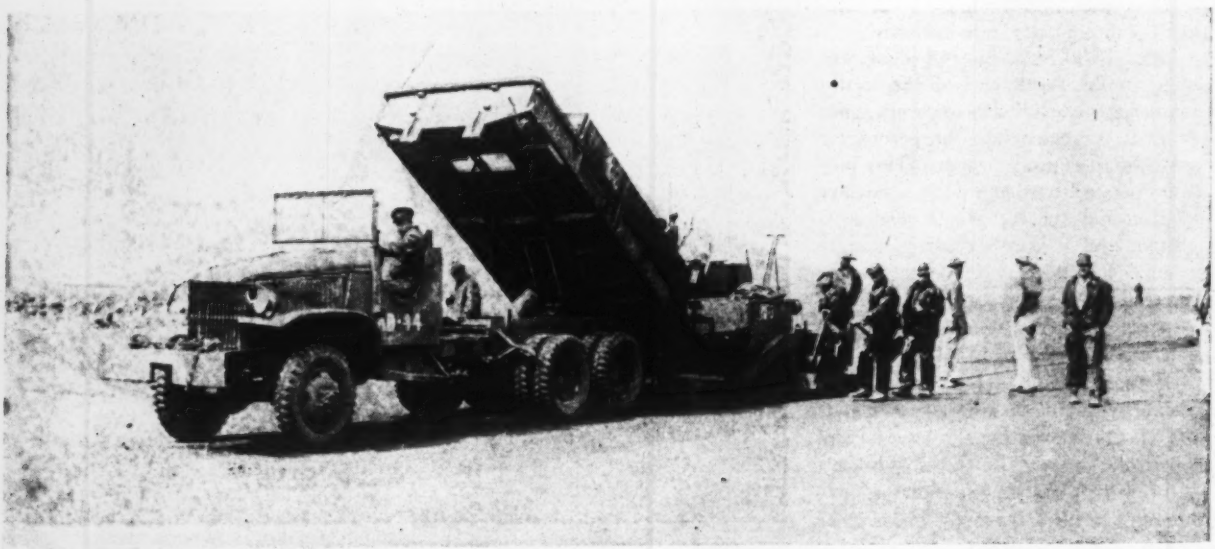


Fig. 5. Runway and apron paving on Santa Maria field was carried out with such typical truck and asphalt spreader combinations as this. A primer of RC-2 was covered with 1½ in. of binder and a 1½ in. wearing surface.

RC-2 asphalt, and in some cases with hot asphaltic cement. Prior to paving operations, the base course was primed with an application of RC-2 asphalt in all cases.

On the aprons, 1¾ in. of asphaltic concrete comprised the binder course laid on an adequately primed stone base and surfaced with 1¼-in. of tar concrete. The tar was used because of its resistance to gasoline and oil spillage, and its thickness was reduced to 1¼-in. since the amount of tar available was limited. An asphalt binder course was laid on the apron for the same reason. The apron also was sand sealed with hot asphalt cement and in some cases with RC-2 asphalt. Runway and taxiway shoulders were treated with a dust palliative of RC-2 asphalt. It was not necessary to pave the shoulders. Approximately 150,000 tons of bituminous hot mix was placed, produced by two stationary plants.

Fig. 6. A steel arched and roofed hangar provides covered maintenance area for the large transport planes.

Bad underground conditions

Excavation presented a number of difficulties. Rock lacked uniformity because of its volcanic origin, varying from hard rock to layers of clay. Consequently, blasting experience gained on one section was useless in an adjacent area, and much secondary blasting was required. Frequently it was necessary to excavate 4 to 5 ft. below subgrade in rock cuts in order to remove mud pockets.

Embankments were constructed mainly from cut excavation and placed in fills under very wet conditions. Excavated material generally contained moisture in excess of optimum, and weather conditions were frequently such as to prevent reduction of moisture content. Excavated areas generally were covered with an average of 1 to 2 ft. of unsatisfactory muck which was removed and either spoiled or placed in slopes outside of the shoulder limits when considered suitable. Practically the entire apron area was stripped an average of 2 ft. deep, all excavated material being unsuitable for fill. Some 2,000,000 cu. yd. of material was excavated for the runway section and an additional 1,000,000 yd. was utilized for cantonment grading and road construction. About 1,000 tons of dynamite was required.

Pneumatic wagon drills were used for drilling, and most of the excavation was moved by long haul equipment consisting of rear and bottom dump diesel trucks from 10 to 13 cu. yd. capacity loaded by power shovels. Tractor-drawn scrapers accomplished short haul excavation.

Aggregates produced locally

A quarry developed at the edge of an existing cliff was drilled by means of five percussion-type drills, with 8-in. holes blasted in increments of about 30,000 lb. to the shot. Two 100-ton-per-hour crushing plants, equipped with primary jaw-type crushers and necessary secondary crushing and screening units produced aggregate in three sizes: 2½-in. stone (crusher run) used in the base course on the runway; 1¼-in. to ⅜-in. for coarse aggregate in asphalt and concrete operations; and ⅜-in. and finer screenings for finer screenings for finer aggregates. Altogether 285,000 cu. yd. of crusher run base material was produced together with 159,000 tons of aggregate.

Run-off charts were not available, but it was assumed for design purposes that the maximum effective rainfall would not exceed 1½ in. per hr. Existing terrain was suitable for drainage purposes. Corrupated metal pipe was used to drain the runway as well as the cantonment area. All head-walls were constructed of rubble masonry. Drop inlets were constructed of both plain and reinforced concrete and provided with both timber and steel grates. Due to the presence of rock, erosion is not a problem, although embankments were given some protection.

The water supply was obtained both from wells and surface sources. Adequate capacity was obtained from wells drilled to an average depth of 275 ft. A permanent water filtration plant, designed to be an adequate standby in the event the wells fail during dry periods, was constructed adjacent to a reservoir formed by building a masonry dam across a small creek. The raw water requires complete treatment, including filtration and sterilization since it is highly contaminated. Softening was not found necessary. The filter plant's capacity is 125 gpm. which can be increased to 185 gpm with the use of semi-portable filtration units. Alum is used for the coagulation of raw water prior to filtration. Chlorination equipment is of the hypochlorite type. The water distribution system was designed as simply as possible, and provides adequate service for maximum domestic requirements and fire protection.

Disposition of sewage

Sewage from all but a few buildings was disposed of by means of a gravity collection system. Small lift pumps were used at two points to avoid heavy cutting.

In some cases, sewer mains were installed in the same trench with water mains in order to reduce the amount of rock excavation. Extreme precautions were taken to preclude the possibility of cross connections between sewer and water supply lines. It was not necessary to provide sewage treatment, since the sewage discharges into the sea over a high cliff at a remote, uninhabited section of the island.

Radiant Heating for an Aircraft Hangar

J. L. Ottenheimer
Consulting Engineer
Albany 6, N. Y.

***Contents in Brief**—Pipe coils embedded in the concrete floor of a large hangar carry hot water to maintain a comfortable temperature inside the structure despite frequent door openings. Variation in temperature is only 2 deg. in the full vertical height of the hangar, and a 60 deg. F. room temperature has proven possible with heat from the floor.*

RADIANT or in-the-floor heating has proved successful for a large test hangar constructed for General Electric Co. at the Schenectady, N. Y. airport. Heating a hangar always is a difficult problem due to the high ceilings and the large areas of doors, which are opened frequently. For this hangar the heating problem is unusually critical as controllable constant temperatures were required for preparation of planes for test flights to prove equipment and devices.

The 170x170 ft. hangar is of the thin-shell concrete arch type, which rises to 45 ft., and gets its support from arch beams on the outside of the structure. Doors open for the full width of the hangar. A two-story office and shop section on one side of the structure is 40x170 ft. but is heated by a conventional steam system.

Design studies, based upon the winter conditions at Schenectady showed the heat loss, when maintaining an air temperature of 60 deg. F., in the hangar, to be 2,000,000 Btu per hr. This included not only the transmission losses but also an allowance for infiltration and opening of the door. The 60 deg. air temperature with radiant heating apparently provides comfort the equivalent of 65 deg. when heating with conventional methods. Greatest heat loss is through the arch roof, despite covering with 1-in. of rigid insulation.

The system, using hot water as the heating medium, is designed for comfort conditions in extreme weather with panel-surface temperature of 85 deg. F. and supply-water temperature at not to exceed 130 deg. (with a permissible drop of 25 deg.) About 20,000 ft. of pipe were required in the hangar floor.

The floor was divided into 20 panels, each 40 ft. long and from 24 to 40 ft. wide. Continuous pipe coils in each panel were used to insure full water circulation with no "short-circuiting." Spacing of the floor pipes in the panels just inside the exterior wall is on 12 in. centers and that in the interior floor panel is on 24 in. centers. The longest radiant panel coil is 1,600 ft., which indicated a 1¼ in. pipe for permissible flow resistance. Under these conditions the required circulation for the water was 240 fpm. and the resistance drop of the system 16 psi.

Wrought iron pipe was used throughout the system as it is readily adapted to bending and welding. All loops and bends were shop-prepared and each panel coil was assembled by field welding on pipe frames above its permanent location and lowered into place. Coils were made with rigid angle iron stiffeners, which also served as chairs to place each coil at the proper elevation in the slab.

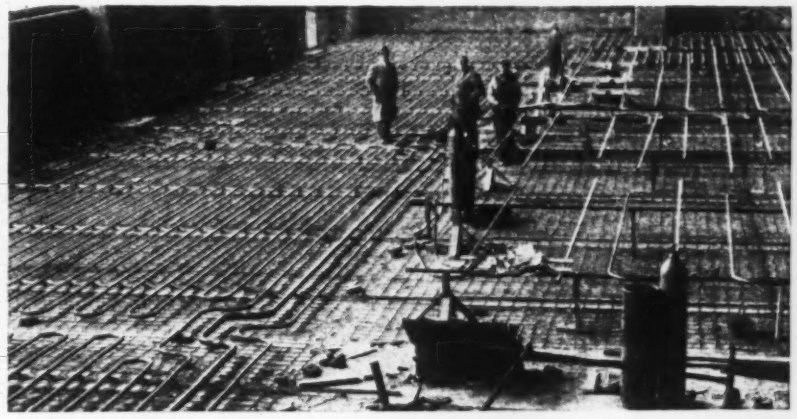
The floor slab thickness required by the weight of the heaviest bomber aircraft was computed at 8 in. when built with adequate reinforcing and placed over 12 in. of compacted gravel fill. The radiant coils were embedded in the floor slab at a nominal depth of 2 in. from the bottom of the slab to the bottom of the coil and placed just over the mesh reinforcing in the slab.

Where main supply and return pipes pass construction joints, pipe bends and covers are used to assure free movement within the concrete slab.

Expansion at pipe joints

Each radiant heating floor panel was isolated from adjacent panels and walls by a preformed expansion joint and separately fed from the central supply. Each floor coil has a manual air-relief valve to prevent air binding, and the system has master automatic air relief valves. The coils of each floor panel are connected to pipe headers through balancing valves. Wherever

Coils were tested for leaks with both water and air. Here a workman looks under a pipe joint with a mirror as he applies soapy solution while the system is under 150 psi. of air.



The hangar floor was divided into 40 ft. long by 24 to 40 ft. wide panels. Pipe coils in the panels around the exterior walls are at 12 in. centers and those in the interior panels at 24 in. centers.

floor panel supply or return lines pass through expansion joints in the floor. movement was provided for by expansion lops, covered with asbestos cell insulation, jacketed with roofing felt. all of which is embedded in concrete.

Tests insure against leakage

The greatest hazard in such an embedded pipe system is the possibility of leaks in the joints, bends and seams. which cannot be repaired when the floor slab is completed. To insure against this hazard a rigorous testing procedure was instituted. After each radiant panel pipe coil was completed and placed in position, and before concreting, it was hydrostatically tested at 150 psi. for 24 hours with a-permissible loss of 5 psi. During this test each joint was hammer-tested. After the water was drained the coil was pneumatically tested at 150 psi. while each joint was inspected for leaks with a soapy solution.

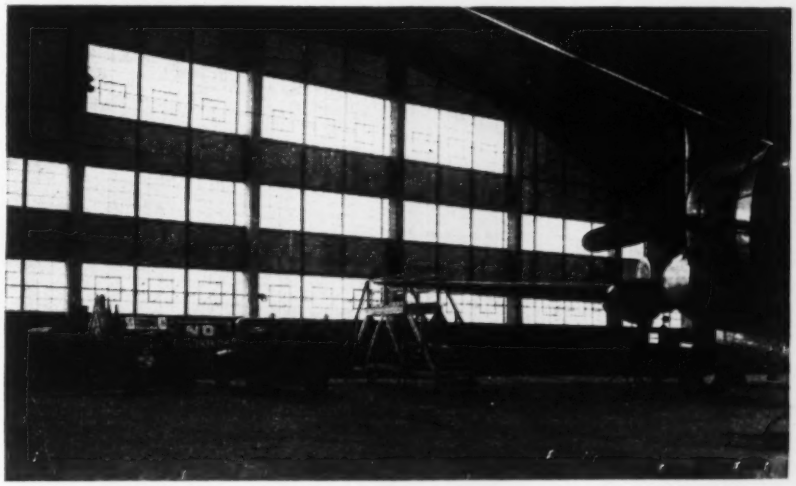
Boiler equipment for the installation consists of two cast iron sectional steam-heating boilers fired by heavy-oil burners. The radiant floor panel coil water is heated by a steam-water heat exchanger. Positive water circulation to the floor panels is obtained with two electric centrifugal pumps. Hangar temperature is controlled by an outside thermostat and a pilot limiting the supply water temperature, the two controls actuating a steam valve to supply heat to the panel water as required.

The system was completed and put into service during March of this year. Necessity required that the radiant floor panels be filled with water when the concrete temperature was 34 deg. F. At this time. the room air temperature was 40 deg. and the outside temperature was 35 deg. After operating for 5 hr. readings showed that the outside temperature had dropped to 25 deg., the radiant floor panel had reached 84 deg. and the room air temperature had risen to 48 deg At the time of these latter readings the temperature of the water entering the radiant floor coils was 130 deg. and the return water temperature was 90 deg. In 15 hr., the room temperature had reached the desired 60 deg., during which time the outside temperature continued to drop. The average vertical temperature showed a variation of less than 2 deg. F. from near the floor to the full ceiling height.

While no extreme winter weather condition prevailed after starting the radiant heating system it is expected from the satisfactory behavior of the system and the tremendous heat "pick-up" shown upon starting and in operation that extreme weather conditions will be met with no difficulty.

T. Napier Adlam assisted the author in the final radiant heating design. Heating Maintenance Corp., heating contractors for the project, developed ingenious methods for assembly and installation with little precedent to guide them in the construction.

Marcus T. Reynolds of Albany, were architects, and Corbetta Construction Co. of New York City were general contractors on the hangar, which was built under supervision of the G. E. Realty Corp. for the parent General Electric Co. of Schenectady.



Radiant heating of floor maintains comfort in 170x170 ft. hangar despite full door opening to pass the largest, B32, bombers.

From Field and Office

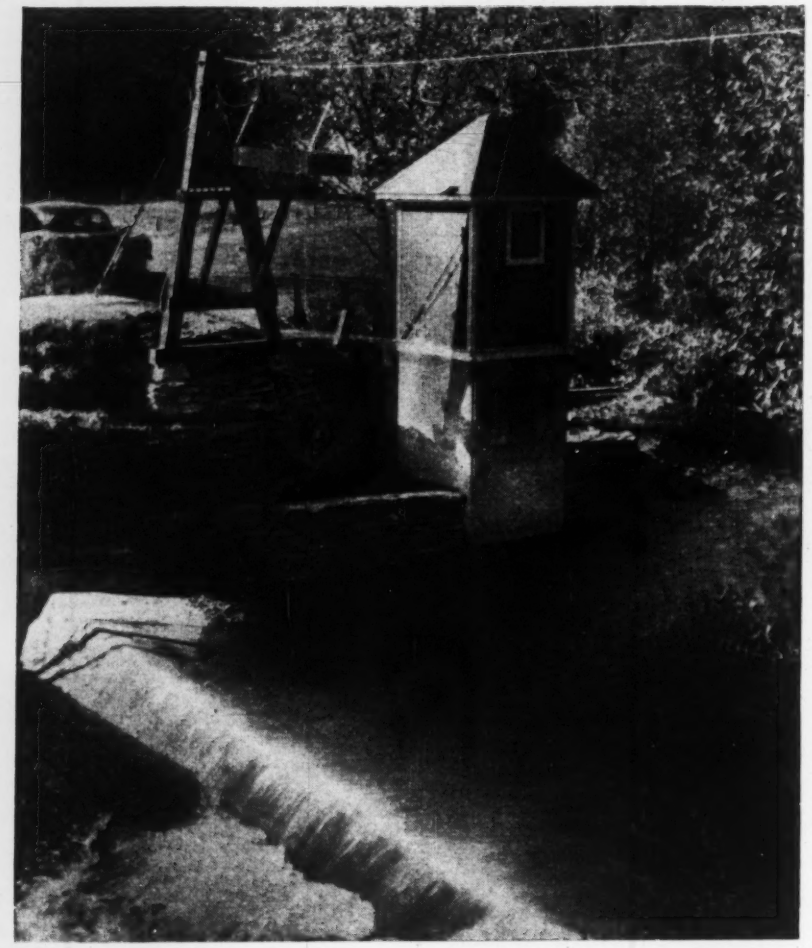
WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERING AND CONTRACTORS

New Type Control For Gaging Stations

A new type of artificial control has been developed by the U. S. Geological Survey for stabilizing the stage-discharge relation of streams having shifting channels and a high silt content. Streams of this type usually carry a heavy bed load of material that quickly fills up the pool above the ordinary type of weir or control structure, thereby destroying its effectiveness by radically changing the cross-section of the channel.

The new type control, as illustrated by the accompanying photo, consists of a smooth concrete apron, ordinarily about 6 ft. wide, with a rise of 1 to 2 ft. between the upstream edge and the crest. The silt or gravel that is moved along the bed of the stream is carried over the inclined apron by the water because of the increased velocity on the apron, thus maintaining an approximately uniform channel upstream and insuring a constant stage-discharge relation. An intake pipe leads from the upstream edge of the apron to a stilling well, where a water-stage recorder obtains a continuous record.

Several installations operated by the Geological Survey have satisfactorily stabilized the stage-discharge relation, resulting in greater accuracy at less expense than was previously possible. —CHARLES C. MCDONALD, *Hydraulic Engineer, U. S. Geological Survey.*



A smooth 6-ft. wide concrete apron with the crest slightly higher than the upstream edge will aid in stabilizing the stage-discharge relation of streams having shifting channels.

Lift-Truck Doubles as Construction Elevator

The adaptability of industrial lift trucks to construction work is amply demonstrated in the accompanying photograph, taken on a factory construction job in the Middle West. Here a lift-truck did duty as an elevator for hoisting bricks and mortar to the bricklayers. A wheelbarrow was loaded on the ground with bricks or mortar and wheeled onto a plank platform resting on the forks of the lift-truck. Then the entire load—bricks, wheelbarrow and workman—was elevated in a matter of seconds to the bricklayers' staging, where the wheelbarrow was dumped.

Photo Courtesy Ross Carrier Co.

Lift-truck serves as elevator on factory construction job, speeding up delivery of materials to upper levels.

This unusual use of a lift-truck tremendously speeded up the bricklaying, as well as a variety of other work, and the entire job moved rapidly to early completion.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

A Use for Atomic Bombs

Sir: The engineering profession may be overlooking an opportunity to put atomic bombs to a useful purpose.

At the present time engineers in charge of the Panama Canal are making plans to convert that channel into a sea level route at an enormous cost. Now that we have available an explosive with undreamed of power, a new canal could be built across Colombia at a fraction of the cost of the proposed work at Panama and in much less time.

The Altrato River in Colombia flows into the Atlantic Ocean and one of its tributaries is only within 20 miles of the Pacific at Jurade. At no point would the cut for the canal need to be more than 300 ft. deep.

Give me a few hundred men and a few atomic bombs and I could blow out a channel to the Pacific as the country is a wilderness where enormous blasts would do no harm. Such a channel could be made ready for use in about a year's time.

ALFRED H. GEDDES
Brooklyn, N. Y.

Thoughts on Exports

The recent editorial in the *Engineering News-Record*, "Perspective on Exports," impels me to raise the question as to how the United States manufacturer is to operate an export market once Europe gets back into production and Asiatic and South American nations become increasingly industrialized. We constantly hear about the superiority of American products and efficiency in comparison with that of other lands but frequently the superiority of product is imaginary. Not long since, we heard a well known radio commentator tell his public that in no country but the United States did a mechanic have the slightest idea of what he was doing; he just did as he was told and kept on doing it until some superior came and told him to stop. Of course that is just so much nonsense. Much that is poured into our ears over the radio and written in popular magazines is, we suspect, put forth merely to flatter us and make us feel good. The fact is that from 1920 to 1938 United States prices on exports were entirely out of line with prices asked by European firms.

For twenty years this writer was associated with British interests operating in South America and during that period frequently had to work out estimates and obtain prices on manufactured articles, not only from this country, but from England, Germany, Holland, Belgium, Scandinavia, Switzerland and Italy. More often than not, the orders went to continental Europe, the decisions having been made on price, meeting of specifications and time of delivery. Even when plans were worked out in England the British found even British prices disadvantageous and cold blooded financiers did not hesitate to patronize Germany, Belgium, Norway and Sweden, or Switzerland. Foreign exchange and its manipulations are evidently not well understood here and we have often had difficulty in explaining to our countrymen why certain large South American enterprises used Belgian francs as a standard in the period 1933-39. After the abolition of the U. S. gold standard and the depreciation of the U. S. dollar, more and more South American purchases shifted to Europe, contrary to expectations. The bald fact was that South American currency, when changed into European currencies, would buy more than that same currency would when transformed into the American dollar. The European prices for the same quality of material were frequently 40% to 60% below American prices.

The heyday of American exporting was really from 1900 to 1913, or at least that was the period when export combined with domestic trade showed best results. Yet, in 1903 this writer purchased a rifle that sold for $24 in the domestic market for $9.50 direct from the manufacturer, merely by accompanying the order with an affidavit from a registered New York export house guaranteeing that the rifle would be taken out of the United States. This was called "dumping" but it kept American shops busy. Later I purchased, in 1932 in Rio de Janeiro, a German made, Leitz binocular, 8 power x 40 mm, for the equivalent of $60; this glass, if obtainable in this country would have cost $200.

It is all very well to boast of high wages and costs and high efficiency but we must not lose sight of the warning that Senator Taft issued some two years past. He said that while we might have the most efficient factories in the world at present, Asiatics, Europeans and South Americans could operate machinery too, and could also learn to organize as well, and that while we might be efficient we were not so efficient as not to sustain a shock when other countries adopted our methods. Just at present we have the world where the hair is short but that condition will not last indefinitely and we must not lose sight of the fact that we have no monopoly on brains and skill.

CHAS. J. SEIBERT
Washington, D. C.

More Bases

Sir: The August 1, 1946 issue just came. You show very nice pictures (vol. p. 138) of "U. S.-built air outposts in Atlantic area". These pictures are fine *but where is Fernando de Noronha?* Ascension was not the only available stop across the South Atlantic. All PV's and PBY's going from Natal or Fortaleza to Ascension *had* to stop by and top off with all the gas they could in order to have a safe margin. I was on Fernando for 11 months and know that about 50 men were mighty glad we were there, for our little base was better than the "Big Drink". The Army built it and had a runway 6,040 ft. (if my memory is good). I was Public Works officer for the Navy on the maintenance of the base.

Hoping to see some picture of it soon.

M. H. LANDER
Civil Engineer
Wilmington, N. C.

(The base at Fernando de Noronha was one of many for which neither pictures nor space were available when

the article referred to went to press. The engineers who built and operated all of these bases are entitled to all the credit possible for their work.—*Editor*)

One-Story Factory Design

Sir: The article, "Cost Study of One-Story Factory," (*ENR* April 18, 1946, vol. p. 560) purports to show the cost of a structure using steel trusses and columns as equal to or less than one of timber construction. As designers, fabricators, and erectors of wood trusses and timber structural frames of the type discussed, we have found that the timber-trussed building usually results in savings of from 10 percent to 20 percent over steel, and frequently even more. In addition, there are often material savings in fire insurance premiums, particularly when slow-burning mill-type construction is used.

A careful analysis of the figures in the various schemes discussed in the article appears to support our position. Some obvious errors are to be found in the computations for the timber alternates; and there are discrepancies not explained in the accompanying notes.

It is difficult to see why Scheme II, using steel trusses, with a total wall area per bay of 16 x 20 x 2 ft., or 640 sq. ft., should require only 650 sq. ft. of concrete, sash and asbestos siding, while the timber alternate, Scheme III, with wall areas of 12 x 20 x 2 or 480 sq. ft., should be saddled with 688 sq. ft. of concrete wall and steel sash. We are aware that there may be several logical arguments for using a different type of wall construction with steel than with timber, but there is no adequate explanation of the very considerable increase in area.

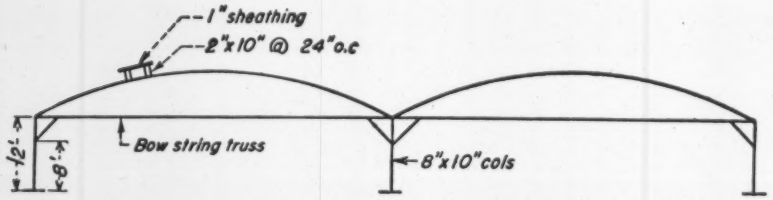
Revised estimates on the timber schemes, using the original figures except as noted, are shown in the accompanying table.

Using the same figures for wall construction as used in steel, several cents more per square foot would be saved, and if the asbestos sheathing above the sash were omitted, as, of course, the 12-ft. sidewall height of the bow-string truss does not require that additional wall area, the cost per square foot of Scheme III would be about 74c., and that for Scheme V would be 77c.

To supplement these comparisons, we suggest the addition of Scheme VI, which would be of heavy timber design. The truss would be of the "strap and pin" type, following the same outline as Scheme IV. With masonry walls, this construction takes a "mill-type" rating, and is classed as of Type II construction of Pacific Coast Uniform Code, eliminating the need for the 20c. per sq. ft. sprinkler cost that the author assesses against light wood structures. This type of construction usually receives a more favorable insurance rate than steel.

Unquestionably, the engineers worked out a very economical building for their client, as the low cost per square foot indicates. We are only interested in pointing out that even greater economy could have been secured through the use of timber.

ED F. MCKEON
Chief Engineer
MACGREGOR GRAHAM
Sales Manager
Summerbell Roof Structures
Oakland, Calif.



SCHEME III—TWO 60-FT. TIMBER TRUSSES

Quantities — 20-ft. Bay		Cost Estimate — 20-ft. Bay	
1-in. sheathing	2,400 b.m.	8-in. concrete wall — 172 × 1.25	= $215
2 x 10 purlins (not 4.000 as given)	2,200	Steel sash — 68 × 1.00	= 68
2 x 10 blocking	400		$283
3 — 8 x 10 columns	240	2 walls — 2 × 283 = $566	
	5,240 b.m.	5.24 m.b.m. @ 130 = 681	
		Trusses = 618	
		$1,865 or $0.78 per sq. ft.	

SCHEME V—TWO 75-FT. TIMBER TRUSSES
(Similar to Scheme III)

Quantities — 20-ft. Bay		Cost Estimate — 20-ft. Bay	
1-in. sheathing	3,000 b.m.	2 walls	= $566
2 x 10 purlins (not 5.000 as given)	3,000	6.74 m.b.m. @ 130	= 876
2 x 10 blocking	500	Trusses	= 988
3 — 8 x 10 columns	240	$2,430 or $0.81 per sq. ft.	
	6,740 b.m.		

SCHEME VI—TWO 75-FT. TIMBER TRUSSES
(Mill-type Construction)

Quantities — 20 ft. Bay		Cost Estimate — 20-ft. Bay	
2-in. sheathing	6,000 b.m.	2 walls	= $566
6 x 8 purlins at 5 ft. c. c.	2,400	9.54 m.b.m. @ 130	= 1,240
Blocking	600	Trusses — 2 × 465 × 1.12	= 1,040
3 — 10 x 12 columns	540	$2,846 or $0 95 per sq. ft.	
	9,540 b.m.		

Tunnel Repairs

Sir: There is an error that requires correction in the article "Practical Repair Methods for Disintegrating Concrete Tunnel Linings" (*ENR*, June 27, 1946, vol. p. 998) prepared by W. W. Morrison and the writer. Under the subhead 'Protective Measures" use of a sulphate resisting cement such as A.S.T.M. Type III is suggested. Actually, Type III is a high-early strength cement. Type II is a moderate sulphate resisting cement and Type V provides high sulphate resistance.

Checking with E. M. Fleming New York district manager of the Portland Cement Association, I am advised that Type II is readily available throughout the country but Type V is not ordinarily carried in stock. Determination of availability of the latter should be made before specifying its use.

ELWYN E. SEELYE
Consulting Engineer
New York 17, N. Y.

UNIT PRICES BID BY CONTRACTORS

Transmission and Distribution Lines for Boysen Unit, Wyoming

OWNER: Bureau of Reclamation, Boysen Unit, Wyoming, Missouri Basin Project; Mr. R. S. Lieurance, Thermopolis, Wyo., Acting Project Engineer.

PROJECT: a) Construction of 34.5-kilovolt single-wood-pole transmission line from existing Pilot Butte-Thermopolis line approximately 12 miles to Boysen Dam construction substation. Conductors to be No. 1/0 A.W.G. bare stranded, steel reinforced, aluminum cable; No 2 A.W.G. bare copper conductor; or copperweld-copper conductor, No. 2A, three strand, No. 2 A.W.G. copper equivalent.

b) Construction of 2400-volt, single-wood-pole distribution line approximately 1½ miles long. Conductors to be of No. 2/0 A.W.G. seven-strand bare copper.

c) Construction of Boysen Government Camp wood-pole electrical distribution system. The 2400-volt primary circuits will use No. 2 A.W.G. stranded, bare copper conductor; the 220/110-volt secondary circuit, three No. 2 A.W.G. weather-proof wire; and street lighting system, No. 4 A.W.G. stranded, bare copper conductor.

CONDITIONS: Government will furnish all transmission-line and distribution-system materials that will be part of the completed work. Contractor is responsible for hauling and storing materials. Completion time, 60 calendar days. Wages: laborers, $0.85, truck drivers, $0.70 to $0.85, air-tool operators, $1.00, carpenters and brush painters, $1.40, and electricians and spray painters, $1.50.

BIDS: Three bids were received April 29, 1946, and award was made on May 29, 1946 on basis of bid item 21(a) and elimination of items 21(b) and 21(c). Bids ranged from the contract low of $29,536 to $45,438.

LIST OF BIDDERS:

1. S. H. Reither, Aitken, Minnesota (contract) $29,536
2. Donovan, Inc., St. Paul, Minnesota 38,814
3. Olson Construction Co., Salt Lake City, Utah 45,438

Item	Quantity	Unit Prices (1)	(2)	(3)
Part 1 — 34.5-kilovolt transmission line				
1. Clear land and right-of-way	lump sum	$500.00	$1,500.00	$1,500.00
2. Constr. SS structures with 35′ pole	10 structures	35.00	48.00	50.00
3. Constr. SS structures with 40′ pole	56 structures	40.00	48.00	60.00
4. Constr. SS structures with 45′ pole	115 structures	45.00	58.00	70.00
5. Constr. SD structures with 40′ pole	2 structures	50.00	50.00	70.00
6. Constr. SD structure with 45′ pole	1 structure	55.00	60.00	80.00
7. Constr. STR structures with 45′ pole	4 structures	55.00	58.00	80.00
8. Constr. SA structures with 40′ pole	2 structures	55.00	50.00	75.00
9. Constr. ST structures with 45′ pole	10 structures	70.00	108.00	100.00
10. Constr. HS structure with 45′ poles	1 structure	70.00	170.00	150.00
11. Constr. HS structures with 50′ poles	5 structures	75.00	180.00	150.00
12. Constr. HT structure with 45′ poles	1 structure	105.00	230.00	150.00
13. Constr. ST structures with 50′ poles	3 structures	115.00	400.00	250.00
14. Constr. two HSWT structures with 40′ poles and two HT structures with 35′ poles, to replace existing pole and make tap connections	lump sum	350.00	1,000.00	1,500.00
15. Constr. single guys with wood strain insulators	10 single guys	8.00	10.00	15.00
16. Constr. double guys with wood strain insulators	5 double guys	12.00	15.00	25.00
17. Place plate anchors	15 plate anchors	10.00	16.00	25.00
18. Install pin-type insulators	600 insulators	1.00	0.50	1.00
19. Assemble and attach suspension-insulator assemblies with two insulator units	18 assemblies	1.00	1.00	2.00
20. Assemble and attach tension-insulator assemblies with three insulator units	30 assemblies	1.50	1.50	3.00
21(a). String No. 1/0 A.W.G. aluminum cable, steel reinf	12 3-ph. circuit mi.	450.00	400.00	500.00
21(b). String No. 2 A.W.G. copper conductor	12 3-ph. circuit mi.	350.00	360.00	600.00
21(c). String No. 2 A.W.G. equiv. copper-weld-copper conductor	12 3-ph. circuit mi.	325.00	360.00	550.00
22. Assemble and attach X-braces	11 X-braces	15.00	8.00	20.00
23. Attach vibration dampers for alum. conductors	100 dampers	1.00	4.00	3.00
Part 2 — 2,400-volt distribution line				
24. Clear land and right-of-way	lump sum	500.00	200.00	500.00
25. Constr. SS structures with 30′ pole	4 structures	25.00	48.00	50.00
26. Constr. SS structures with 35′ pole	8 structures	30.00	48.00	50.00
27. Constr. SS structures with 40′ pole	5 structures	35.00	48.00	60.00
28. Constr. SD structure with 30′ pole	1 structure	35.00	50.00	50.00
29. Constr. SD structures with 35′ pole	2 structures	40.00	50.00	50.00
30. Constr. SD structure with 40′ pole	1 structure	45.00	50.00	70.00
31. Constr. ST structures with 40′ pole	2 structures	90.00	100.00	100.00
32. Constr. ST structures with 45′ pole	2 structures	70.00	108.00	100.00
33. Constr. SA structures with 55′ pole	2 structures	90.00	64.00	100.00
34. Constr. SAT structures with 55′ poles	2 structures	65.00	120.00	125.00
35. Constr. stub guys with 30′ poles	2 stub guys	28.00	50.00	75.00
36. Constr. single guys	18 single guys	6.00	10.00	15.00
37. Constr. double guys	8 double guys	10.00	15.00	25.00
38. Place plate anchors	28 plate anchors	10.00	16.00	25.00
39. Install pin-type insulators	63 insulators	1.00	0.50	1.00
40. Assemble and attach single-unit tension insulators	24 assemblies	1.00	1.00	1.50
41. String three No. 2/0 A.W.G. hard-drawn, bare, 7-strand copper conductors	1½ 3-wire circuit mi. of line	450.00	400.00	700.00
Part 3 — Electrical distribution system				
42. Set 30-foot poles	5 poles	15.00	20.00	30.00
43. Set 35-foot poles	25 poles	20.00	20.00	35.00
44. Set 40-foot poles	35 poles	25.00	20.00	40.00
45. Set 45-foot poles	20 poles	30.00	24.00	45.00
46. Assemble and attach single four-pin cross arms to poles	10 cross arms	6.00	4.00	10.00
47. Assemble and attach double four-pin cross arms to poles	15 cross arms	14.00	10.00	20.00
48. Assemble and attach single six-pin cross arms to poles	20 cross arms	8.00	4.00	15.00
49. Assemble and attach double six-pin cross arms to poles	40 cross arms	17.00	10.00	20.00
50. Assemble and attach transformer foot arms to poles	20 arms	17.00	2.00	5.00
51. Install pin-type insulators	250 insulators	1.00	0.30	0.50
52. Attach structure numbers to poles	85 numbers	1.00	0.30	1.00
53. Install secondary racks on poles	50 racks	3.00	2.00	3.00
54. Install secondary racks on houses	80 racks	3.00	2.00	3.00
55. Attach dead end straps to secondary racks	40 straps	1.00	1.00	1.00
56. Install insulated clevises	160 clevises	1.50	2.00	1.00
57. Install one 10-kv.-a. transformer on pole, compl. with protective equip	4 transformers	20.00	50.00	25.00
58. Install one 15-kv.-a. transformer on pole, compl. with protective equip	4 transformers	30.00	50.00	30.00
59. Install one 25-kv.-a. transformer on pole, compl. with protective equip	6 transformers	50.00	50.00	40.00
60. Install one 37.5-kv.-a. transformer on pole, compl. with protective equip	2 transformers	75.00	70.00	50.00
61. Install one 50-kv.-a. transformer on pole, compl. with protective equip	1 transformer	100.00	100.00	75.00
62. Install two 10-kv.-a. transformers per pole, compl. with protective equip	1 set	40.00	100.00	40.00
63. Install two 15-kv.-a. transformers per pole, compl. with protective equip	1 set	60.00	100.00	50.00
64. Install two 25-kv.-a. transformers per pole, compl. with protective equip	1 set	100.00	100.00	75.00
65. Install two 37.5-kv.-a. transformers per pole, compl. with protective equip	1 set	150.00	140.00	90.00
66. Install two 50-kv.-a. transformers per pole, compl. with protective equip	1 set	200.00	240.00	125.00
67. Install three 10-kv.-a. transformers per pole, compl. with protective equip	1 set	60.00	120.00	60.00
68. Install three 15-kv.-a. transformers per pole, compl. with protective equip	1 set	90.00	120.00	75.00
69. Install three 25-kv.-a. transformers per pole, compl. with protective equip	1 set	150.00	120.00	100.00
70. Install 10-kv.-a. constant current regulator (transformer) on pole, compl. with oil switch and protective equip	1 regulator	70.00	100.00	100.00

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2. Model T2 cleaning a landslide from a highway
3. A Missouri township's T2 loads sand for 1½ miles of road a day
4. Model T4 taking up and loading old highway concrete

Transmission and Distribution Lines for Boysen Unit, Wyoming

Continued from preceding page

Item	Quantity	Unit Prices (1)	(2)	(3)
71. Install ground wire on poles	400 ft.	0.10	0.10	0.50
72. Install ground connections	14 connections	3.00	6.00	2.00
73. Constr. stub guys with 30-foot poles	5 stub guys	28.00	50.00	30.00
74. Constr. single guys	40 single guys	5.00	10.00	15.00
75. Constr. double guys	10 double guys	10.00	15.00	25.00
76. Place plate anchors	50 plate anchors	10.00	16.00	25.00
77. String three No. 2 A.W.G. bare copper conductors	4,000 3-wire-circuit ft. of line	0.07	0.24	0.15
78. String two No. 2 A.W.G. bare copper conductors	2,000 2-wire-circuit ft. of line	0.05	0.16	0.13
79. String two No. 4 A.W.G. bare copper conductors	2,000 2-wire-circuit ft. of line	0.04	0.16	0.12
80. String one No. 4 A.W.G. bare copper conductor	1,000 Single-wire-circuit ft. of line	0.02	0.12	0.10
81. String three No. 2 A.W.G. weather-proof wires	3,000 3-wire-circuit ft. of line	0.10	0.24	0.20
82. String three-wire service drops with two No. 2 A.W.G., and one No. 4 A.W.G. weatherproof wires	7,000 3-wire-circuit ft. of line	0.10	0.30	0.25
83. String two-wire service drops with two No. 2 A.W.G. weatherproof wires	4,500 2-wire-circuit ft. of line	0.07	0.24	0.20
84. Install bracket street lamps	20 lamps	5.00	10.00	10.00

Spillway and Embankment, Blue Mountain Dam, Arkansas

OWNER: U. S. Engineers, Little Rock, Arkansas.

PROJECT: Completion of concrete spillway and embankment, Blue Mountain Dam, on the Petit Jean River, near Waveland, Yell County, Arkansas.

CONDITIONS: All materials furnished by contractor. Transportation by Rock Island Railway and State Highway 10. Contract time, 360 calendar days. Common labor wages are $.65 per hour, semi-skilled $.75 to $1.00, and skilled, $1.25 to $1.50 per hour.

BIDS: Six bids were received March 5, 1946 at Little Rock, Arkansas, ranging from the contract low of $1,010,447.80 to $1,699,563.30.

The contract amount is 7 percent below the government estimate of $1,091,379.00.

LIST OF BIDDERS:

1. S. E. Evans Const. Co., Fort Smith, Ark. (contract) $1,010,447.80
2. Ryan Const. Corp., Evansville, Ind. 1,246,444.50
3. M. R. Thomason, Contr., Montgomery, Ala. 1,247,237.50
4. Morrison-Knudsen Co. Inc., Little Rock, Ark. 1,309,048.00
5. R. B. Potashnick, Cape Girardeau, Mo. 1,328,281.00
6. Porter-DeWitt Const. Co., Poplar Bluff, Mo. 1,699,563.30

Item	Quantity	Unit Prices (1)	(2)	(3)
1. Care and diversion of river	sum job	$15,000.00	$60,000.00	$35,000.00
2. Stripping—embankment and dikes	13,000 cu. yd.	.20	.35	.40
3. Common excavation—general	250,000 cu. yd.	.35	.45	.46
4. Common excavation—borrow areas	1,100,000 cu. yd.	.33	.36	.40
5. Rock excavation—general	23,000 cu. yd.	1.45	2.25	3.50
6. Rock excavation—trenches	900 cu. yd.	15.00	14.30	15.00
7. Close line drilling	9,500 sq. ft.	1.00	1.05	.85
8. Drilling—3" holes	3,000 lin. ft.	.75	.88	.75
9. Core drilling—3" holes	2,500 lin. ft.	3.00	3.30	2.70
10. Pressure grouting	4,000 cu. ft.	2.00	2.20	1.60
11. Foundation preparation	710 squares (100 sq. ft.)	15.00	16.50	14.50
12. Protective treatment for shale	700 squares (100 sq. ft.)	5.00	6.60	7.00
13. Bituminous cover for shale	150 squares (100 sq. ft.)	5.00	6.60	7.00
14. Extension of settlement gages and seepage wells	280 lin. ft.	2.00	2.00	1.00
15. Backfill	9,500 cu. yd.	.70	1.50	.75
16. Selected and random impervious fill	630,000 cu. yd.	.10	.12	.12
17. Random pervious fill	80,000 cu. yd.	.16	.12	.12
18. Rolling each add'l pass sheepsfoot roller	80,000 squares (100 sq. ft.)	.02	.02	.025
19. Rolling each add'l. pass tractor	6,000 squares (100 sq. ft.)	.02	.04	.025
20. Sand—drain and backing	14,000 cu. yd.	2.75	3.48	3.10
21. Crushed rock or gravel	6,000 cu. yd.	2.00	3.85	3.50
22. Gravel surfacing—roadways	3,000 cu. yd.	2.00	4.00	3.00
23. Dumped riprap	32,000 cu. yd.	1.50	2.25	2.40
24. Rock gutters	300 cu. yd.	20.00	6.00	14.00
25. Reinforcing steel	600,000 lb.	.07	.075	.07
26. Furnishing cement	14,000 bbl.	3.25	3.58	3.20
27. Concrete—spillway walls	4,900 cu. yd.	20.00	22.55	20.30
28. Concrete—weir, floor and cut-off wall	5,400 cu. yd.	10.70	14.00	11.50
29. Concrete—curb	150 cu. yd.	22.00	23.10	22.00
30. Furnish and install perf. concr. pipe, 6"	660 lin. ft.	.80	1.00	.95
31. Furnish and install perf. concr. pipe, 8"	900 lin. ft.	1.15	1.45	1.30
32. Install perf. concr. pipe, 18"	468 lin. ft.	1.10	1.00	1.00
33. Furnish and install perf. concr. pipe, 18"	330 lin. ft.	3.00	3.50	3.25
34. Furnish and install perf. concr. pipe, 30"	500 lin. ft.	7.00	8.25	7.00
35. Concrete pipe, 24"	100 lin. ft.	3.50	4.70	4.25
36. Manholes	2 ea.	500.00	305.00	450.00
37. Copper water stops	5,600 lb.	.60	.66	.75
38. Setting anchors	290 ea.	2.00	1.95	2.00
39. Black steel pipe	1,000 lb.	.15	.17	.20
40. Highway posts	600 ea.	3.25	3.10	3.00
41. Highway guardrail	1,700 lin. ft.	1.40	1.50	1.50

Core Drilling at Hogan Dam, near Valley Springs, California

OWNER: War Department, U. S. Engineer Office, Sacramento, Calif.

PROJECT: Drilling approximately 800 lin. ft. of "NX" core, depth ranging from 100 to 150 ft. in foundations and from 15 to 35 ft. in concrete, and drilling approximately 40 lin. ft. of 6 in. core in concrete about 10 ft. deep.

CONDITIONS: Job site approximately 3½ miles by road from Valley Springs, Calif. Completion date, 45 calendar days from notice to proceed. Prevailing wages, $1.50 for skilled labor, $1.25 for semi-skilled, and $1.00 for common labor.

BIDS: Four bids were received April 22, 1946 at Sacramento, Calif., ranging from the contract low of $6,505.50 to $9,991.25. The contract amount is 4 percent below the Engineer's Estimate of $6,785.

LIST OF BIDDERS:

1. Frank L. Howard Engrg. Co., Los Angeles $6,505.50
2. Mitchell Diamond Drill Co., San Francisco 6,557.50
3. Processed Diamond Bit & Tool Co., San Francisco 7,268.75
4. Daniel C. Longtin, San Francisco 9,991.25

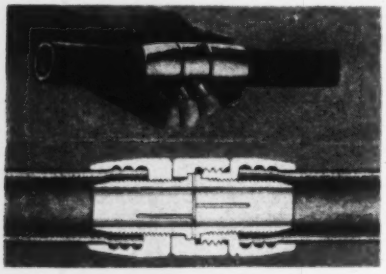
Item	Quantity	Unit Prices (1)	(2)	(3)
1. Mobilization and demobilization	1 job	$160.00	$280.00	$250.00
2. Overburden drilling	50 lin. ft.	5.50	6.00	5.00
3. Drilling NX core in concrete	100 lin. ft.	6.50	6.35	5.00
4. Drilling NX core in rock	700 lin. ft.	5.50	5.50	6.50
5. Drilling 6-in. core in concrete	40 lin. ft.	12.00	6.50	12.50
6. Casing or pipe left in hole	75 lin. ft.	1.50	1.50	1.65
7. Reaming	50 lin. ft.	3.50	2.50	2.00
8. Cementing and drilling out cement	150 lin. ft.	2.00	2.50	2.50
9. Pressure testing	70 hr.	8.00	5.00	5.00
10. Drill set-up for NX holes in concrete	2 each	15.00	40.00	40.00
11. Drill set-up for NX holes in rock	7 each	15.00	40.00	40.00
12. Drill set-up for 6-in. diameter holes in concrete	4 each	2.00	40.00	40.00

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

Open-Bowl Scrapers — Production has started on open-bowl scrapers, designated as Nos. 80, 70 and 60, for respective struck measures of 13.8, 8.7 and 6.0 yards. In addition to the open-bowl design for greater stability and visibility, others of the several new features include: High apron lift to clear the stickiest materials; positive, clean ejection; exceptionally long cable life due to correct reeving, over-sized precision-grooved sheaves; double-curved, self-sharpening cutting edges; optional tire sizes.—*Caterpillar Tractor Co., Peoria, Ill.*

Rail Cropper—Constructed of cold rolled steel plate for rigidity and lightness, the Airco rail cropping machine is assembled with spacers and through bolts, and with all accessory parts bolted in position. A three-point contact automatically positions the cropper to make a square cut when placed on the rail. Two torches are provided, joined together by a 5/16-in. hose, with tee connections, so that both can be operated from a single pair of pressure regulators. The cropper weighs 61 lb. with torches and measures approximately 38x21x11½ in. The top torch cuts through the ball and a portion of the web. The bottom torch, supported in an inverted position, cuts the base from below and severs the uncut portion of the web.—*Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.*



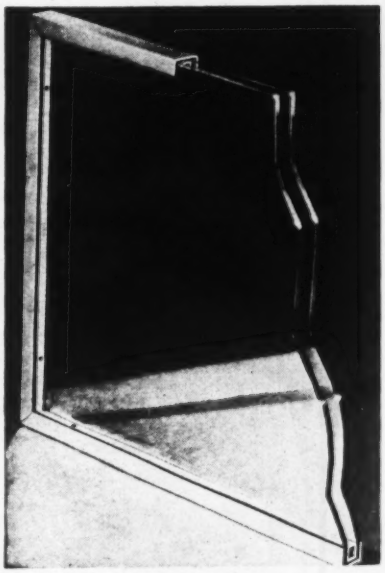
Streamlined Hose Coupling—Smaller and lighter in weight than former couplings, a streamlined, high-pressure hose coupling is used for fire, chemical, oil and spray hose where pressures exceeding 1,000 psi. are employed. Cross-section shows method of locking hose into position between outer shell walls and internal expander units. Horizontal grooves provide wrench grip for tightening expander units inside nut. Maintenance of full diameter of hose at coupling assures uninterrupted flow and maximum efficiency.—*Bar-Way Mfg. Co., Stamford, Conn.*

Slide Rule—Said to have remarkable dimensional stability, precision graduations on a new 10-in. plastic slide rule are not affected by temperature change. The glass indicator is mounted in a stainless steel frame that holds it firmly in place. Tension on the slide may be easily adjusted by four screws on the back of the rule.—*Charles Bruning Co., Inc., 4754-10 Montrose Ave., Chicago 41, Ill.*

Globe Pattern Valve—Representing a marked advancement in valve design Grove series "V" and "VL" valves, extreme thirty deg. valve body design in the globe pattern, effect a minimum change in the direction of flow. Turbulence is almost entirely eliminated, as the flow stream is carried through the valve in the direction of closing. Expansion takes place directly into the downstream line after the flow has passed through the valve, automatically removing wire drawing and cutting action.

A solid one piece stem and plug gives tight shut-off when closed. The valve stem is not directly carried by the handwheel which removes any chance of the stem becoming distorted or bent. All shocks are absorbed by a multiple full threaded section of the handwheel and yoke. All threaded surfaces and operating parts are protected from paint, dirt and damage by an encasing cap shield.—*Grove Regulator Co., 65th & Hollis Sts., Oakland, Calif.*

Unloading Unit—A new unloader is hydraulically operated by the driver from his regular position. Two double acting hydraulic cylinders move a vertical rack forward, pushing the load off the forks. Many applications of the unloader are possible, for its pulling power is equal to pushing power.—*Towmotor Corp., 1226 E. 152nd St., Cleveland 10, Ohio.*



Double-Glazed Window—A double-glazed window insulating unit, Twindow, consists of two or more plates of glass enclosing a ¼ or ½-in. hermetically

HORTON SPHEROIDAL TANK at Washington, D.C.

The Horton spheroidal elevated water tank shown above is providing gravity water pressure in the Second High service area in the Washington, D.C. water system.

The tank provides a reserve of water, independent of direct pumping, to supply increasing consumption in a rapidly expanding demand area and to relieve low-service suction of peak demand withdrawals for high service pumping.

The fluted central cylinder is new in elevated tank design. It serves primarily to support the center of the tank bottom and does not contain water. There is a separate 5-ft. diam. riser on the inside that is connected to the mains.

This spheroidal tank is only one of the many types of elevated tanks we have been called upon to design, fabricate and erect for a special service. Our nearest office will be glad to give you additional information on the advantages of elevated water storage. Write today.

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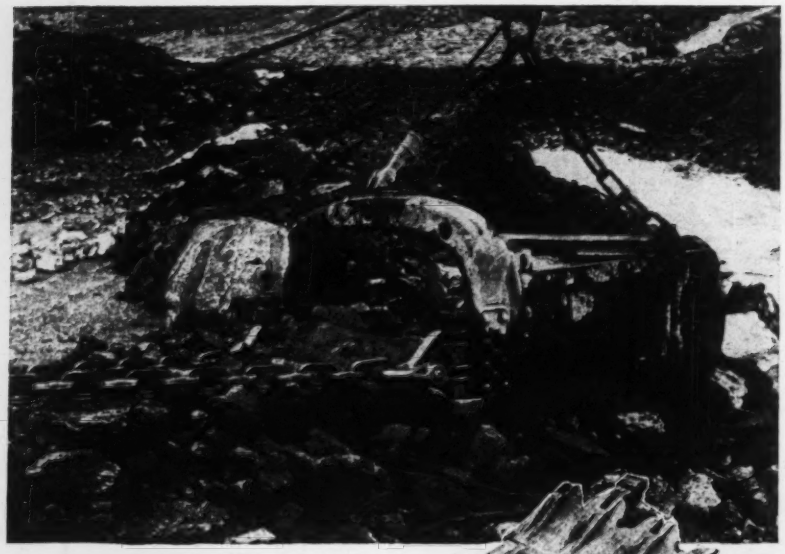
New York 6.....3311 - 165 Broadway Bldg.
Cleveland 15.....2201 Guildhall Bldg.
Detroit 26.....1506 LaFayette Bldg.
Philadelphia 3.....1623 - 1700 Walnut St. Bldg.
Tulsa 3.....1617 Hurt Bldg.
Birmingham 1.....1520 North Fiftieth Street
Atlanta 3.....2125 Healey Bldg.
Washington 4.....703 Atlantic Bldg.
Houston 1.....5609 Clinton Drive
Los Angeles 14.....1411 Wm. Fox Bldg.
San Francisco 11.....1220 - 22 Battery Street Bldg.

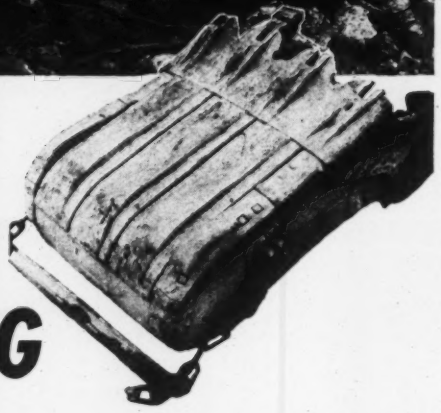
Plants in BIRMINGHAM, CHICAGO, and GREENVILLE, PENNA.

In Canada—HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.



Above: ESCO 1½-yard heavy duty bucket operated on Bucyrus 37, digging steel slag in Republic Steel plant.

Right: bottom view of same bucket after six months on this job.



DIGGING STEEL SLAG WITH *ESCO* DRAGLINE BUCKETS

Digging up acres of compacted steel slag is as hard on dragline buckets as any job possibly can be. Yet it was done successfully by the Heckett Engineering Corporation of Butler, Pa., using *ESCO* dragline buckets.

Pieces of slag averaged over three feet in diameter. Some of the work was under water. After buckets of three other makes had broken down on this job, an *ESCO* heavy duty bucket was put into service. After working six months it is still going strong and ready for more.

Service like this is typical of *ESCO* dragline and dipper buckets. It results from sound design by practical, experienced engineers who put strength where it is needed, engineer out excessive weight.

Manganese steel castings are used for all parts subject to shock and wear, grow harder and tougher the more they work.

An *ESCO* dragline or dipper bucket will make that tough job of yours more profitable. Get full information from your nearest *ESCO* representative, or write us.

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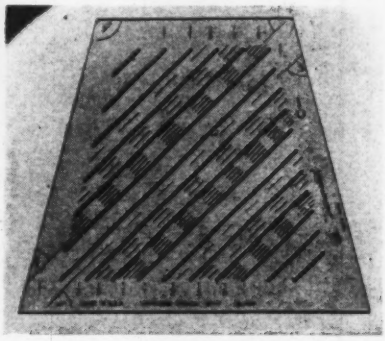
IN CANADA—*ESCO* LIMITED, 1084 Homer St., Vancouver, B. C. Telephone Marine 2343

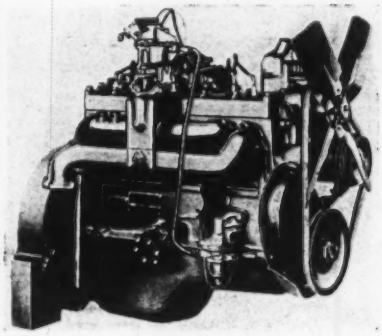
sealed air space. Hollow aluminum tubing is used to separate and hold the glass plates in position. The entire unit is framed with .015 to .020 gage stainless steel channel, with the channel legs extending 3/8-in. inward on the surface of the glass from the base around its periphery. Twindow is said to virtually prevent condensation.

Clear polished plate glass is used in the standard unit, but special glass can also be fabricated. Specially developed production processes make it possible to provide a wide range of sizes in any combination of straight edges; it is also possible to produce certain simple cylindrical bends within definite limitations.—*Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh 22, Pa.*



Hatching Stencil—time required for cross-hatching is shortened, it is claimed, by use of the "Instrumaster" hatching stencil. With this device hatching is evenly spaced, and precision markings enable the user to predetermine exact location of the hatching.

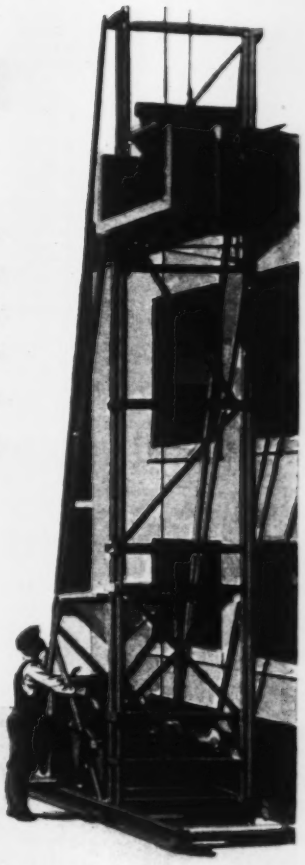
This non-warping, non-inflammable plastic stencil has indelibly debossed aligning marks and lettering; lines at 30, 45 and 60 deg. to the horizontal can be drawn without a separate triangle.—*Instrumaster Industries, Inc., Greenwich, Conn.*

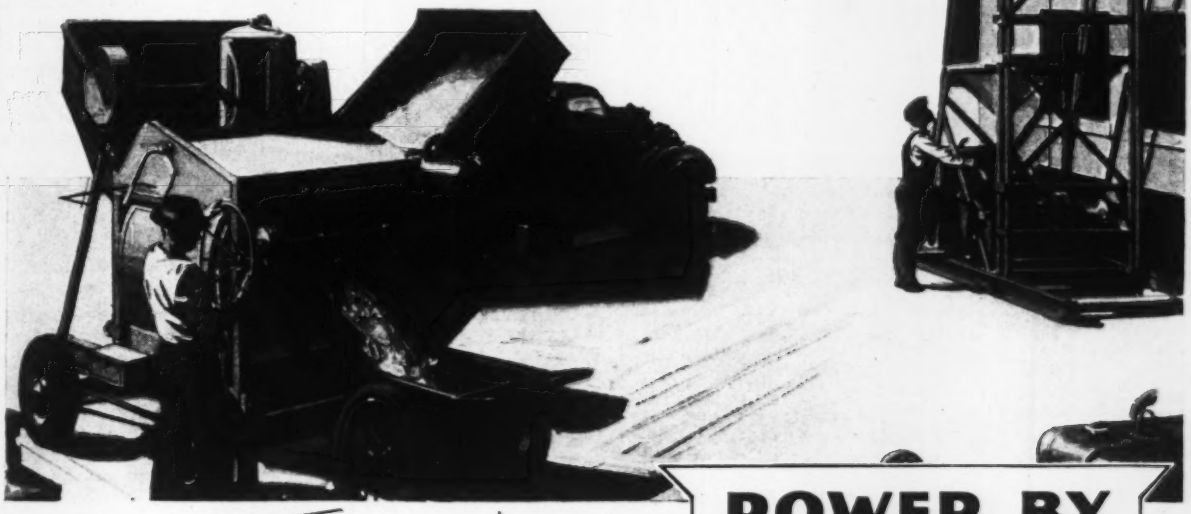


Improved Industrial Engines—Well suited to cranes, shovels, pumps, compressors, tractors, etc., new Chrysler industrial engines are said to be very flexible, with a reserve of rugged power. Models Ind. 5 (illustrated), Ind. 7 and

CONTINENTAL POWER
is Built to the Job

There are no "Jacks of all trades" in the broad line of Continental Red Seal engines. Whether it's a truck, a concrete mixer, a hoist or an air compressor, there is a Continental engine especially built for every individual power need of construction, transportation or industry. Thus, job and engine are matched for most efficient performance — for long, dependable operation at lowest possible cost.





The Continental F-600 closed power unit develops up to 55 horsepower for numerous applications requiring intermittent duty. It is also available as a power plant, or as an open power unit. The engine, a 6-cylinder L-head model, embodies such time-proven Red Seal features as individual porting, removable tappets, and full-length water jackets.

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Red Seal Engines

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Look for the Continental Red Seal It Identifies the Finest In Every Field of Power

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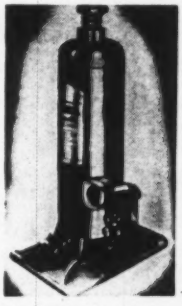
Ind. 12 are now offered, with the following features: Rigid cylinder block; cylinder bores integral with cylinder block to obtain perfect alignment with crankshaft, insure against water leaks and provide efficient heat transfer; bearings designed to take 2½ times the stresses actually imposed on them; water-cooled exhaust valves; optional sodium-cooled valves; superfinishing of parts, chrome plated piston rings.—*Chrysler Corp., Detroit, Mich.*

Truck Crane Remote Control—On-the-job mobility for truck carrier and crane is the objective of the remote control device now available in P&H truck cranes. With it, one man, from the crane operator seat, can start the carrier engine, operate the clutch, shift gears, steer the truck, blow the horn and apply the brakes.

The control panel set up in the crane cab is connected with solenoid air valves by a center pin. The electrically controlled compressed air instantly actuates each carrier function. The panel is for the most part a push-button instrument board; the brake, however, utilizes a pull-out switch.—*Harnischfeger Corp., Excavator Division, Milwaukee 14, Wis.*

Hydraulic Jack—The Nu-Hydro Liftmaster jack with a base of forged steel



is said to be exceptionally durable and to eliminate leakage through porous castings. The pump piston is of tool steel hardened and ground and the bronze guide bearing with a long bearing surface is used at bottom of precision-ground ram.

This jack has been streamlined to have few drilled holes, simple mechanism and no cotter keys. It has minimum starting height, maximum hydraulic lift and screw extension. Six models are available, of 3 to 30 tons capacity.—*The Joyce-Gridland Co., Dayton 3, Ohio.*

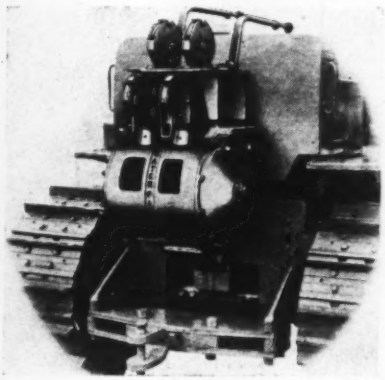
Luminiscent Sheeting—New forms of "Lucite" acrylic resin containing luminescent pigments—a fluorescent type which glows when exposed to ultraviolet, or "black" light, and a phosphorescent type which glows in the dark after exposure to ordinary light—indicate a promising future on highways, airlanes and sealanes. It is now being investigated by the U. S. Coast Guard for large bands on channel markers and buoys to light them at night without necessitating

maintenance or replenishment of a power supply. The plastic has demonstrated durability on exposure to severe weather or salt water.

The afterglow of this phosphorescent sheeting is claimed to be outstanding in the field of plastics. After exposure to light, the sheeting gives light of maximum brilliance for a matter of minutes, and then continues for ten or twelve hours to give light sufficient to be seen by an eye adapted to the dark.—*E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.*

Industrial Recording Pen—An improved capillary pen for three-pen rectangular industrial recording instruments is a single-tube type. The end in contact with the instrument chart is swaged to a smaller diameter, while the capillary is less than half the diameter of earlier design. A smaller tube restricts ink flow, which eliminates flooding. Pen friction is minimized and smooth action assured, it is stated, even where the instrument has low actuating force.—*Brown Instrument Co., division of Minneapolis-Honeywell Regulator Co., New York, N. Y.*

Transparent Waterproofing—Leakage in outside walls of brick and stucco buildings can be stopped, it is claimed, by application of S/V Ceremul W, a transparent water-proofing wax emulsion. This emulsion, to be put on by brush, may be diluted in one or two parts of water, depending on how porous is the surface to which it is applied. Application of only one coat of this non-inflammable product—a dispersion of a selected blend of petroleum waxes in water—is sufficient, preferably in warm weather.—*Socony-Vacuum Oil Co., Inc., 25 Broadway, New York 4, N. Y.*



Rear Double-Drum Cable Control—The No. 25 cable control design, based on exhaustive studies, embodies many refinements and heavy service features; it is used on "Caterpillar" diesel D8, D7 and D6 tractors in the operation of the

A—The Kinnear Motor Operator saves effort, time, and manpower. It goes into action instantly at the touch of a control button—opening, closing, or stopping the door with smooth speed and efficiency. It's a sturdy, integral unit featuring a specially designed torque-output motor, machine-cut gears, and bronze bushings that assure lasting, trouble-free operation.

B—The same bull-dog ruggedness and high operating efficiency are featured in the sturdy, all-steel, interlocking-slat construction of Kinnear Rolling Doors. Coiling into small space above the lintel, Kinnear Doors permit full use of *all* floor and ceiling space around doorways, remaining out of the way and safe from damage when open. These and other basic advantages have made Kinnear a first choice for nearly half a century!

C—Remote Control adds still further convenience and economy by permitting more strategic placing of control buttons, or centralized control stations for any number of doors. It helps eliminate doorway "bottlenecks," and cuts heating and air-conditioning costs by encouraging prompt door closure at all times. Remote control assures maximum advantages from the smooth, easy, time-saving action of Kinnear Motor Operated Rolling Doors.

Write today for complete information on the ABC'S of dependable door satisfaction at its best.

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Ariz., Phoenix, Lee Redman Co.
Cal., San Francisco, Coast Equip. Co.
Cal., Los Angeles, Golden State Equip. Co.
Colo., Denver, Power Equipment Company
Conn., New Haven, Wilhelm-Davies Co., Inc.
Fla., Miami, Allied Equip., Inc.
Fla., Orlando, Highway Equip. & Supply Company
Tampa, Epperson & Company
Ga., Atlanta, Tractor & Machinery Company
Ida., Boise, Olson Manufacturing Company
Ill., Chicago, Chicago Construction Equipment Co.
Ky., Harlan, Crousborn Equip. & Supply Co.
Maine, Portland, Maine Truck-Tractor Company
Mass., Allston, Boston, Clark-Wilcox Co.
Mich., Muskegon, Lakeshore Machy. & Supply Co.
Minn., Minneapolis, Phillippi-Murphy Equip. Co.
Miss., Jackson, Jackson Road Equip. Co.
Mo., Clayton, The Howard Corporation
Montana, Billings, Interstate Truck & Equip. Co.
Helena, Caird Eng. Works
N. J., No. Bergen, American Air Compressor Corp.
N. M., Albuquerque, Bud Fisher Co.
N. M., Roswell, Smith Machy. Co.
N. Y., Albany, Milton-Hale Machinery Company
New York, Hodge & Hammond, Inc.
N. Y., Olean, Freeborn Equip. Co.
N. Y., Syracuse, Milton-Hale Mach. Co.
N. D., Fargo, Smith Commercial Body Works, Inc.
O., Cincinnati, Carroll-Edwards Co.
Okla., Oklahoma City, Townsco Equip. Company
Ore., Portland, Andrews Equip. Service
S. C., Columbia, Smith Equipment Company
Tenn., Knoxville, Dempster Bros., Inc.
Tenn., Memphis, Independent Tractor Co.
Tenn., Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Tex., Dallas, Shaw Equip. Co.
Tex., Houston, Contractors Equip. Sales & Service Corp.
Tex., San Antonio, Patten Machy. Co.
Utah, Salt Lake City, J. K. Wheeler Mach. Co.
Vt., Barre, A. M. Flanders, Inc.
Wash. Spokane, Andrews Equip. Service
Wisc., Milwaukee, Drott Tractor Co. Inc.

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Md., Baltimore, Stuart M. Christhilf & Company
Mich., Detroit, T. G. Abrams
Mo., Kansas City, Brown-Strauss Corp.
Neb., Lincoln, Highway Equip. & Supply Co.
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O., Cleveland, H B. Fuller Equip Company
Pa., Philadelphia, Giles & Ransome
Pittsburgh, Arrow Supply Company

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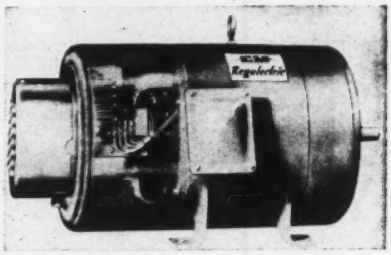
Little Rock, R. A. Young & Son
Ind., Indianapolis, Reid-Holcomb Company
Ky., Louisville, Williams Tractor Company
La., New Orleans, Wm. F. Surzi Equip. Company
Md., Baltimore, D. C. Elphinstone, Inc.
Mass., Cambridge, Field Mach. Company
Mich., Detroit, W. H. Anderson Co., Inc.
Flint, Gransden-Hall & Company
Mo., Kansas City, Mach. & Supplies Co.
N. Y., Buffalo, Dow & Co., Inc.
New York, Air Compressor Rental & Sales
O., Cleveland, Gibson-Stewart Company
Toledo, The Kilcorse Mach. Co.
Pa., Allentown, H. N. Crowder, Jr., Inc.
Easton, Sears & Bowers
Harrisburg, American Equip. Corp.
Oil City, Freeborn Equipment Company
Pittsburgh, Atlas Equip. Corp.
Pa., Phil. Metalweld, Inc.
Wilkes-Barre, Ensminger & Company
Texas, El Paso, Equip. Supply Company
Va., Richmond, Highway Mach. & Supply Co.
Wash., Seattle, Star Machinery Company
Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Buy Blue Brutes

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

largest scrapers, bulldozers and rippers. Smooth, easy operation with a minimum of adjustments is featured; the multiple disc clutch with metallic facings and synchronized brake release and clutch engagement add to smooth operation. Designed to permit rapid free spooling when desired, the control responds quickly and virtually eliminates operator fatigue.

Other outstanding features include large-diameter, specially grooved sheaves; large brake capacity; longer life through use of anti-friction bearings and recessing of cable drums in the case; compact design permitting improved balance; and a rugged cast steel case assuring freedom from distortion.—*Caterpillar Tractor Co., Peoria, Ill.*



A. C. Generator—A new unit provides general-purpose electric power at constant voltage, using built-in voltage regulating circuit employing principles of series resonance. It will maintain voltage within 2 percent of its rated value from no load to full load withnormal engine speed regulation and is instantly responsive to sudden load changes. Regulating circuit has no moving parts. Available in ratings from 5 to 15 kw.—*Electric Machinery Mfg. Co., Minneapolis* 13, *Minn.*

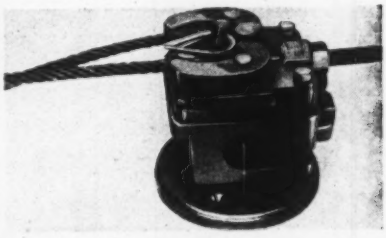
Synchronous Motor Welder — A synchronous motor welder, utilizing an inbuilt separate exciter, is so proportioned that it can be started across the line and automatically synchronize itself by the buildup of the exciter. The starting current on this unit is approximately the same as a conventional induction motor of the same horsepower capacity. This machine can also be used as an AC Generator for the operation of small tools, lathes, grinders, etc.—*The Hobart Brothers Co., Troy, Ohio.*

Aluminum Roll-Up Awning — An aluminum awning for industrial plants that automatically rolls up into a neat compact roll at the top of the window, has just been announced. Named "Alumaroll", and made of 100 percent non-corrosive aluminum, advantages of not sagging, shrinking or stretching, are claimed by the maker. Finished in a protective coat of baked aluminum enamel, it is available in a range of pleasing colors to harmonize with any plant exterior.

This awning provides a permanent, practical and low-cost method combining protection and controlled light at the lowest possible cost per year of service. It is stated it keeps plant temperatures down in summer, thus relieving air-conditioning systems; in winter, it may be easily rolled up, allowing the winter sun's heat to ease the heating system load in the cold months. The awning will not chip, rust or rattle and it will provide full ventilation as well as any degree of shade—*Aluminum Awning Co., Division of Orchard Bros., Inc., 423 Meadow Road, Rutherford, N. J.*

Two-Ton Electric Hoist—The Yale line of Midget King electric hoists now includes a 2-ton model to fit many industrial applications. Light in weight, yet producing plenty of fast lifting power, the hoist is equipped with a 1 hp. motor. Lifting and lowering action is obtained by a flip of the wrist on the one-hand bar-grip control. To carry the load, a strong, light weight alloy steel roller chain is used with a special steel load hook.

The hoist is available with hook for stationary use and with a permanently attached trolley for use on an overhead track. Accessories include a chain container for collecting slack chain, eliminating kinking and keeping the chain away from the worker and the load.—*Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia 24, Pa.*



Wire Loop-forming Vise — A new vise forms a loop in wire rope by simply turning one hex nut with an ordinary wrench. This Cabl-Vise automatically compensates for rope sizes and holds the loop firmly when splicing or clamping. It has a swivel base and may be used in vertical or horizontal position, rotating through 360 deg. Cabl-Vise No. 2, with

IT'S A BEAUTY FOR LOOKS... A BRUTE FOR WORK

This Worthington 210′ Blue Brute Compressor is a brute from the word "Go". It pushes out air to those WJ-45 Rock Drills with an ease that means everything from low fuel consumption to long years of the hardest kind of work.

Underneath that handsome exterior is a "heart of steel" — the Worthington Feather* Valve that users recognize as the simplest, most efficient ever made. You'll also find such money-saving features as three-point suspension of engine and compressor as a single unit (that's for eliminating vibration and shock) . . . force-feed lubrication . . . an exclusive idling control . . . and other Worthington features that help you turn the fewest dollars of power into the greatest amount of work, meanwhile keeping the machine fit in the face of the most rugged service.

Hook up the 210 with Blue Brute Rock Drills, Paving Breakers or other Air Tools and watch them tear into their work. You'll be getting a first-hand picture of why *there's more worth in Worthington!* See your nearby Worthington distributor.

*Reg. U.S Pat. Off.

H8-3

KNOW YOUR BLUE BRUTES

Your Blue Brute Distributor will gladly show you how Worthington-Ransome Blue Brute construction equipment will put your planning on a profitable basis. His name is listed on page 126. Blue Brutes include:

RANSOME EQUIPMENT

Pavers, Concrete Spreaders**, Concrete Mixers, Concrete Placing Equipment, Big Mixers, Finishing Machines**, Pneumatic Placing & Grouting Equipment, Truck Mixers, Plaster & Bituminous Mixers, and related equipment.

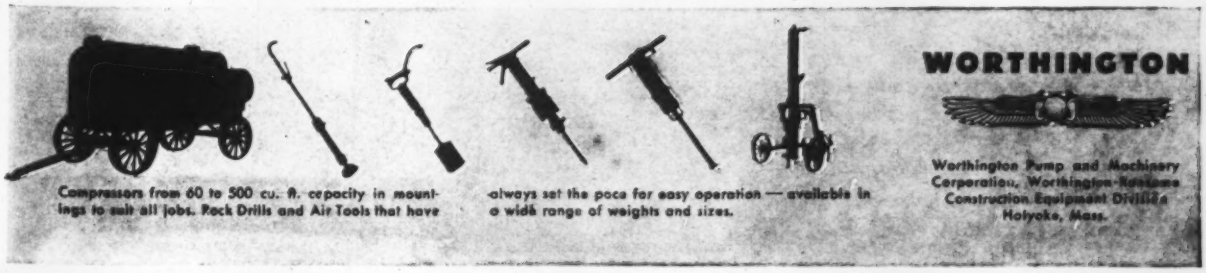
WORTHINGTON EQUIPMENT

Diesel and gasoline engine driven Portable Compressors from 60 to 500 cu. ft. capacity in mountings to suit all jobs; Rock Drills and Air Tools in a wide range of weights and sizes; Contractors' Pumps**.

**To be announced

Get more **WORTH** *from air with* **WORTHINGTON**

BUY BLUE BRUTES



Compressors from 60 to 500 cu. ft. capacity in mountings to suit all jobs. Rock Drills and Air Tools that have always set the pace for easy operation — available in a wide range of weights and sizes.

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.

DOUBLE DUTY CHIP-WELD GOGGLES CUT ACCIDENTS . . . *and their cost!*

Many a worker facing two hazards—welding and chipping for instance—will often take a chance rather than take the trouble to change goggles. In the Willson DC50 Chip-Weld Goggles you have two pairs in one to provide full-time protection and a consequent reduction in eye accidents.

A flip up with a finger and your welder becomes a chipper with eyes protected by heat treated Super-Tough* lenses. Another flip down and he's ready to return to welding. The weld lenses, available in eight different shades, are protected from pitting by clear, beveled cover glass.

The eye cups are anatomically shaped; are amply ventilated through indirect ports; and may be worn over prescription spectacles.

*T.M. Reg. U. S. Pat. Off.

Willson-Weld* lenses down in correct position for welding.

Hinged portion raised for chipping, grinding, peening or other eye hazardous work.

For help with your eye and respiratory problems, get in touch with your Willson distributor or write direct.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON PRODUCTS INCORPORATED

Established 1870

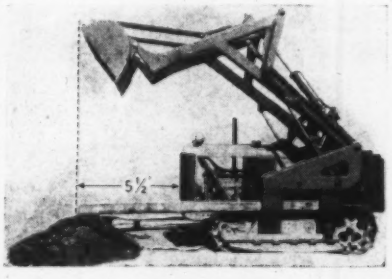
100 THORN STREET • READING, PA.

WILLSON 75 YEARS

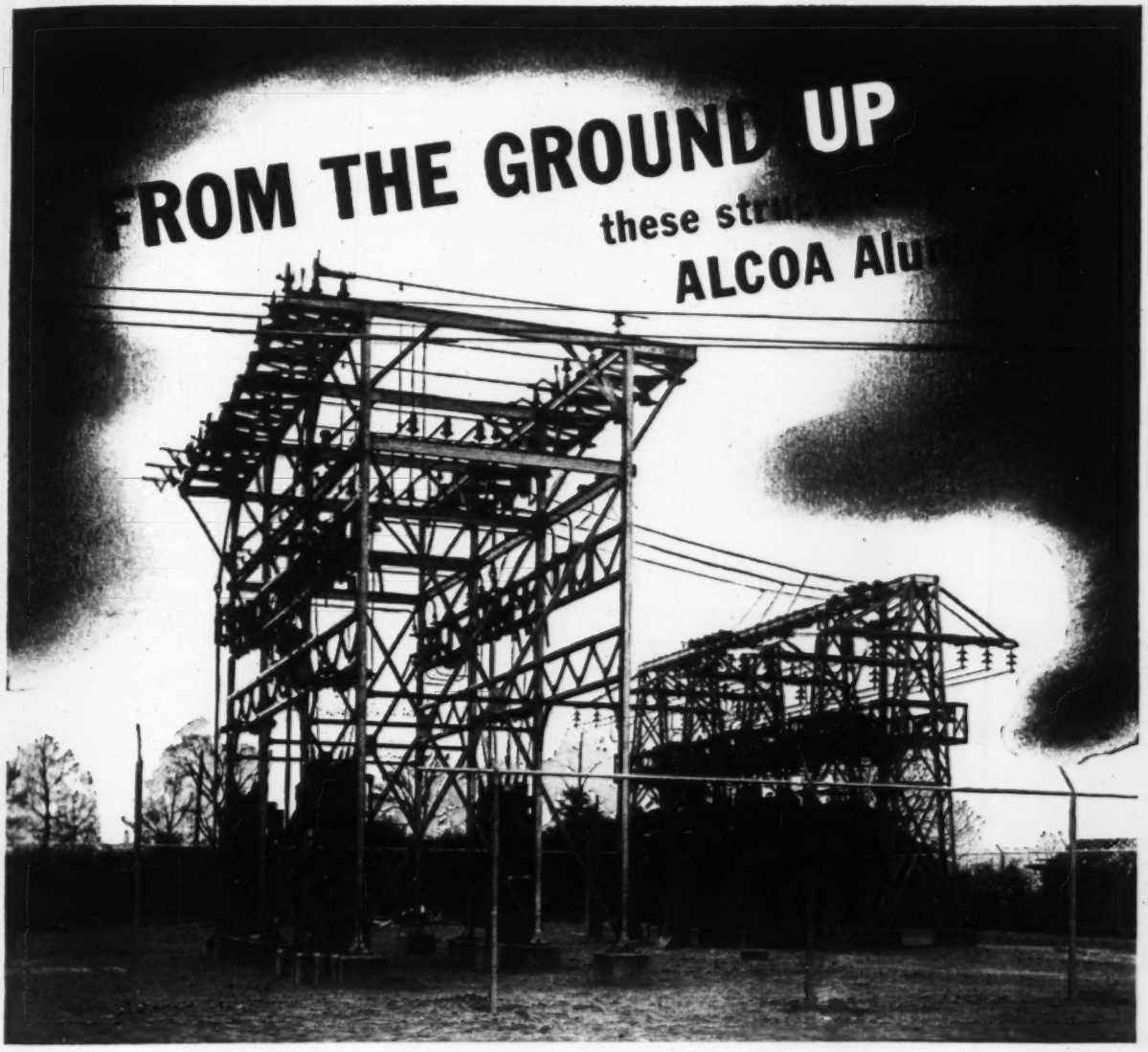
hydraulic booster, for ⅝ through 1½-in. rope will soon be available.—*Vunn Manufacturing Co., Evanston, Ill.*

Street Light Control—An electronic outdoor light control device has been developed to avoid duplicate power networks on lighting installations and is not affected either operationally or physically by wide temperature extremes, high humidity, blizzard or direct desert sunlight. The unit can be easily mounted on a pole and oriented to the north by a lineman. It is supplied complete with heavy galvanized mounting bracket to fit 6—8-in. dia. pole.—*Fisher-Pierce Co., 82 Ceylon St., Boston 21, Mass.*

Grease Gun Loader — Loading of hand guns, long a vexing and often wasteful problem to users of pressure lubrication systems, has been resolved into a simple, quick operation by new equipment that eliminates disassembly of the hand gun. A new "gun-loader fitting" is mounted on the head of a hand gun and permits grease to flow *into* the grease reservoir of the gun in the same manner that it flows into a bearing through a lubrication fitting in normal lubrication. *Alemite Division, Stewart Warner Corp., Chicago, Ill.*



High-Lift Loader—A new front-end tractor loader, the Drott Hi-Lift loader, with extremely high lift and reach, is



4kv. and 11kv. Powell Avenue substations of the Pennsylvania Electric Company at Erie, Pa. Fabricated by: Railway & Industrial Engineering Company of Greensburg, Pa.

All parts of these structures are nonrusting Alcoa Aluminum. Painting is eliminated, cutting maintenance costs, reducing service interruptions, decreasing hazards.

Lightweight assemblies permit more shop fabrication—less field work—save erection time and costs.

Standard Alcoa Aluminum shapes, plate, bolts and rivets—lightweight, strong, highly resistant to corrosion, readily available—make it possible for you to obtain these advantages in your structures.

For design data and prices, call the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2108 Gulf Building, Pittsburgh 19, Pa.

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Reduced Rates (see table) include special pick-up and delivery between airport towns and cities. Rapid air-rail schedules to and from 23,000 other communities in this country.

Foreign Service direct by air to and from scores of foreign countries — the world's best service, in the world's best planes.

Write Today for the Time and Rate Schedule on Air Express. It contains illuminating facts to help you solve many a shipping problem. Air Express Division, Railway Express Agency, 230 Park Avenue, New York 17. Or ask for it at any Airline or Railway Express office.

RATES CUT 22% SINCE 1943 (U. S. A.)					
AIR MILES	2 lbs.	5 lbs.	25 lbs.	40 lbs.	Over 40 lbs. Cents per lb.
149	$1.00	$1.00	$1.00	$1.23	3.07¢
349	1.02	1.18	2.30	3.68	9.21¢
549	1.07	1.42	3.84	6.14	15.35¢
1049	1.17	1.98	7.68	12.28	30.70¢
2349	1.45	3.53	17.65	28.24	70.61¢
Over 2350	1.47	3.68	18.42	29.47	73.68¢
INTERNATIONAL RATES ALSO REDUCED					

AIR EXPRESS

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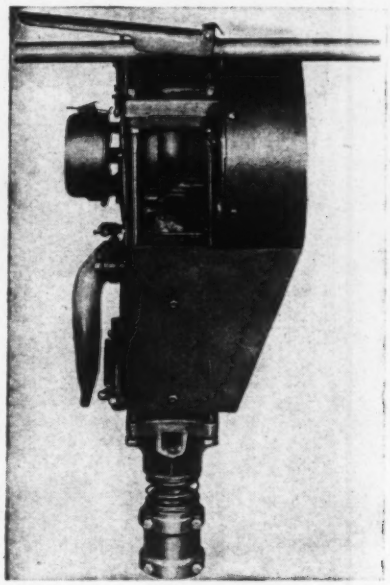
Representing the AIRLINES of the United States

designed for mounting on Oliver Cletrac crawler tractors. It has a lift of approximately 10 ft. 8 in. and dumps its load about 5 ft. ahead of the radiator.

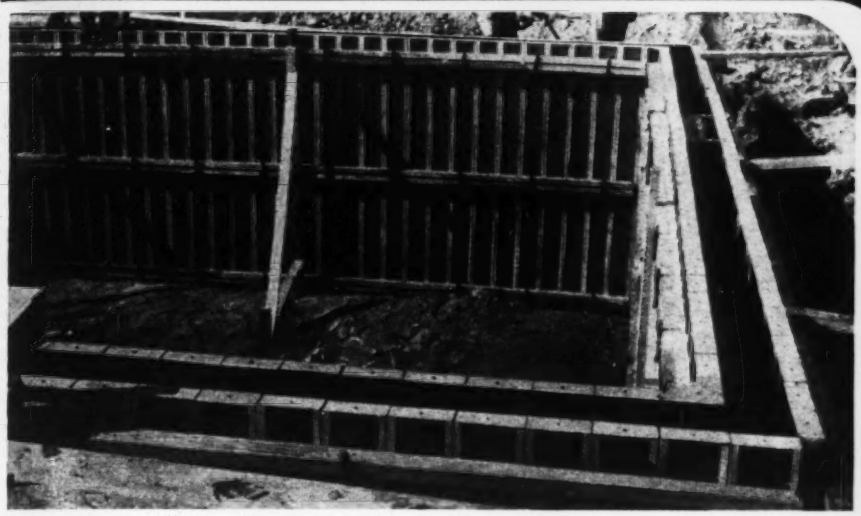
The standard bucket has a capacity of 1-¼ yd. A light material handling shovel of 1-¾ yd. is available for the handling of coal and other light materials. The unit is hydraulically operated and equipped with a front-mounted pump.—*Drott Mfg. Corp., Milwaukee 9, Wis.*



Spike Driver—An improved gasoline hammer spike driver has a nose end tool retaining casting shortened to reduce overall height of tool to 32 in., which decreases the weight to 92 lb. The completely self-contained hammer is made up of a single cylinder, air-cooled gasoline engine with flywheel ignition and forced ventilation air-cooling. The engine cylinder contains one conventional engine piston and one striking or hammer piston; the latter acts as a movable cylinder head.—*The Syntron Co., 328 Lexington Ave., Homer City, Pa.*

Aluminum Roof Paint—A reflecting, protective covering over a structure, providing longer life for the surface and reducing inside temperatures by as much as 15 degrees, is provided by a new aluminum paint. Processed from a high quality gilsonite asphalt base and fortified with a specially processed pure aluminum paste, the paint has an aluminum pigment which "leafs" to the surface to form a foil-like metallic shield against the elements. This double-purpose paint is suitable for use on smooth or slate roll roofing, asphalt shingles, built up, slag or metal roofs. It is also made for outside metal work. *United Gilsonite Laboratories, Scranton, Pa.*

ATLAS LABOR-SAVING *SPEED* FORMS



Housing Project at Portchester, N. Y. Portchester Fuel Company, Developers.

A House Foundation A Day

New Process for Concrete Construction For Rent or Sale

Engineers and Contractors are amazed at the speed and savings they make with Atlas STEEL Forms. In housing projects, they get a sound, water-proof foundation a day, including stripping, moving, erection and pouring at a much lower cost than with cinder block or wood forms. In apartment house, Industrial and heavy construction, they make savings of 25% and more in comparison with wood forms. Finish is smooth and uniform—no grain marks—nothing to remove. Irregularities and inserts are easily accomodated. Light-weight—anyone can lift them. Strongly built of steel—good for an indefinite number of uses.

Available for Early Delivery

Send for Illustrated Folder

Some New Users

The Tyler Corp., Falls Church, Va.
Housing Project
Churchill Fulmer Assoc., N.Y.C., Arch.
Progar Bldrs. Inc., Radburn, N. J.
Housing Project
Fred J. Roughgarden, Hawthorne, N. J., Arch.
Worsham Bros., Knoxville, Tenn.
Housing Project
Louis Belli, Inc., Flushing, L. I.
Housing Project
Sanderson & Porter, Frankfort, Ky.
National Distillers Bldg.
A. Friederich & Sons, Rochester, N.Y.
Gen. Railway Sig. Co.
H. L. Stone & J. G. Shea, Archs.
H. K. Ferguson Eng. Co., Cleveland
Sherwin Williams Plant,
Cleveland, Ohio
Homer T. Borton, Arch.
A. J. Glaser, Muncie,
Saginaw Malleable Iron Works, Danville, Ill.
General Motors Corp., Arch.

Everyone wants a House With a Sound Foundation and Dry Cellar

Costs Less Than Cinder Blocks

Because you Save both on labor and materials.

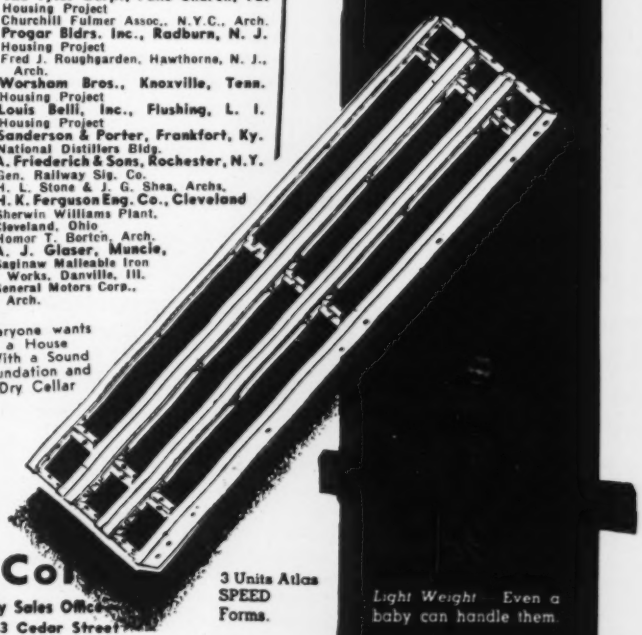
Better Than Concrete Block

Solid and easier to waterproof

WEDGE BOLT

Speedy Erection Forms go together quickly with no thread bolts.

Union Carpenters Will Handle Speed Forms.



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ATLAS STEEL FORMS FOR EVERY PURPOSE

Men and Jobs

W. B. Stevenson has opened an office as consulting engineer in Superior, Wis. A graduate of the University of North Dakota, Mr. Stevenson has been assistant state engineer of North Dakota in charge of bridge design, city engineer and county surveyor at Fargo, and district engineer and state field engineer for the WPA.

George T. Parkin, senior bridge designer of the North Carolina State Highway and Public Works Commission, Raleigh, has resigned to go with William C. Olsen, consulting engineer, Raleigh. Mr. Parkin went to the highway commission in 1930 and was at one time bridge construction engineer.

Alfred Blakesley is city engineer and water department superintendent for Monrovia, Calif. Formerly he was engineer for the United Concrete Pipe Corp.

Otto Hallden recently returned as a sanitary engineer to the Illinois Division of Sanitary Engineering, Department of Public Health, Springfield. He had been an employee of the division for two years prior to joining the Army Corps of Engineers in 1942.

Alvin F. Darland has resigned as superintendent of City Light, Tacoma, Wash., to take an administrative position with the Bureau of Reclamation's Columbia Basin Project headquarters under Supervising Engineer Frank A. Banks. He had completed 11 years with the agency when he took the superintendency of Tacoma City Light in 1945. In his new assignment he will direct all construction, operation and maintenance of the bureau for the Coulee Dam area and for the equalizing reservoir in the Grand Coulee.

Mr. Darland

D. W. Moulton, city engineer of Chattanooga, Tenn., since 1943, has resigned to become city manager of Kingsport. He was with the Tennessee Highway Department except for a brief period with W.P.A. before going to Chattanooga. He will aid Kingsport in its plans for improvement of streets, water systems.

Tennessee Valley Authority has announced the appointment of **George K. Leonard** as project manager in charge of the Wautauga and South Holston Dam projects in upper east Tennessee. For the last two years, Leonard has served as chief of the project planning division of T.V.A.'s water control planning department. He joined T.V.A. in December, 1933, as assistant construction engineer on Wheeler Dam. In 1941 he was made chief project manager in charge of the Hiwassee project.

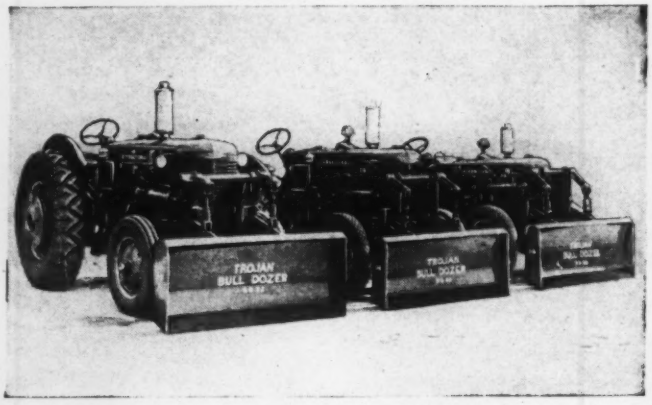
Kenneth Shelling, civil engineer graduate of the University of Oklahoma, has been employed by the Tulare County Planning Commission, Visalia, Calif., as assistant planning engineer.

R. L. Campbell, of Covington, principal assistant district engineer of the Kentucky Department of Highways, will become district engineer on Sept. 1, succeeding **Marion D. Ross.** Mr. Ross resigned to become executive secretary of the Plantmix Asphalt Industry of Kentucky with headquarters at Frankfort.

Thomas G. Harton, recently returned from active duty with the Corps of Engineers as lieutenant-colonel, has joined the Bureau of Reclamation and is located in the engineering assistant's

TROJAN

COMBINATION BULLDOZER AND SNOW PLOW
for
International Industrial Wheel Type Tractor

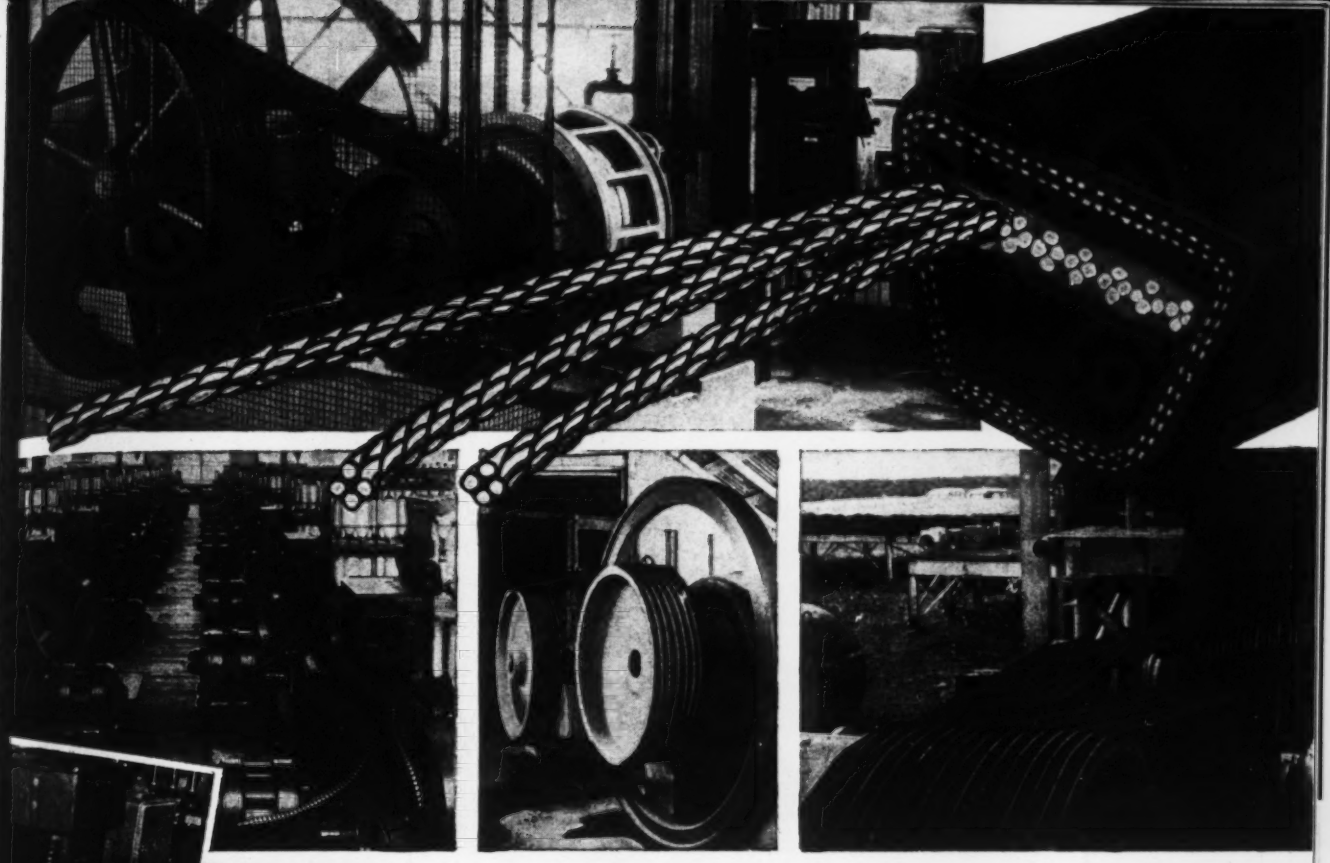


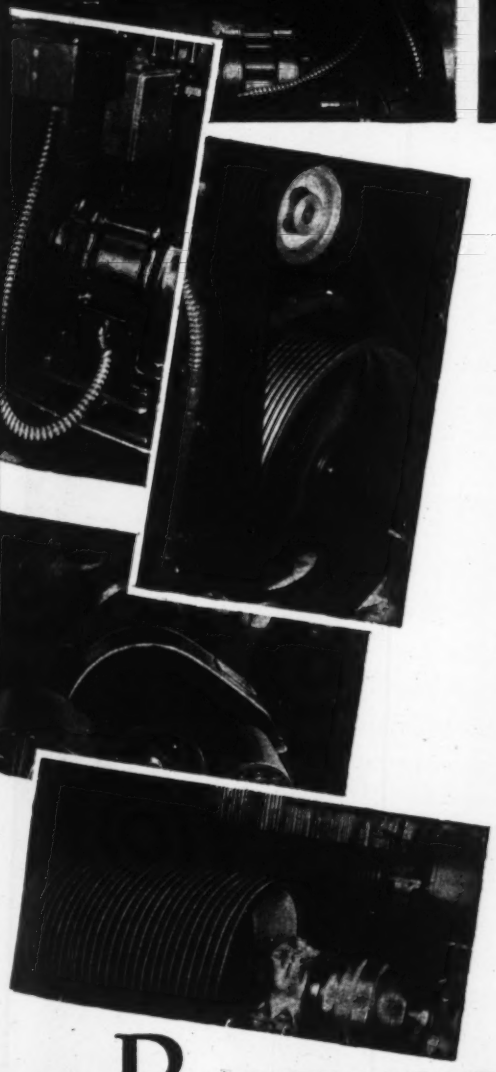
There is plenty of low cost power behind this newest Trojan Tool. It has been carefully engineered to cover the widest possible use on all work requiring rubber tired tractors.

The one control valve insures easy operation. There is full axle clearance and the draw bar and rear power take off shaft is left free for attaching other equipment. Two snow plow units are also available—either a V-type or reversible one-way plow.

For details see your International Industrial Distributor

CONTRACTORS MACHINERY CO., INC.
Dept. NR 62 Batavia, N. Y.





8 DISTINCT ADVANTAGES in Condor Whipcord V-BELT

1. Wide margin of strength
2. Minimum inelastic stretch
3. Uniform flexi
4. Maximum resistance to structural breakdown
5. Smooth running
6. Maximum tra
7. High resistance to side wear
8. Correct lateral reinforcement

The outstanding difference in Condor V-Belt construction is the Whipc *Strength Member* illustrated in the above cross section. This backbone of dr power is composed of strong strands of cotton cord made to Manhattan's c specifications, impregnated and encased in strong, tenacious, slow ag *Flexlastics* . . . Other factors being equal, the useful life of a V-Belt is limitec excessive stretch. The function of the Condor Whipcord *Strength Mem* section is to take the load and prevent undue stretch.

V-Belt Bulletin #6868B (mailed on request) gives more details of the lc wearing construction and includes helpful tables.

Available also in Paranite G.O.P. (Gas Oil-Proof) and Non-Spark compou of Flexlastics.

The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN may make FLEXLAS MANHATTAN Belts will be made in the red color when again possible.

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MEMO TO ALL CONSTRUCTION SUPTS.
For Bigger Payload Performance
...the logical first choice is HAISS HI-POWER. Unique for Sta-in-line reeving, out-of-the-muck sheaving. Weight placed for highest digging power, with closing ratios up to 7:1. Write for facts.
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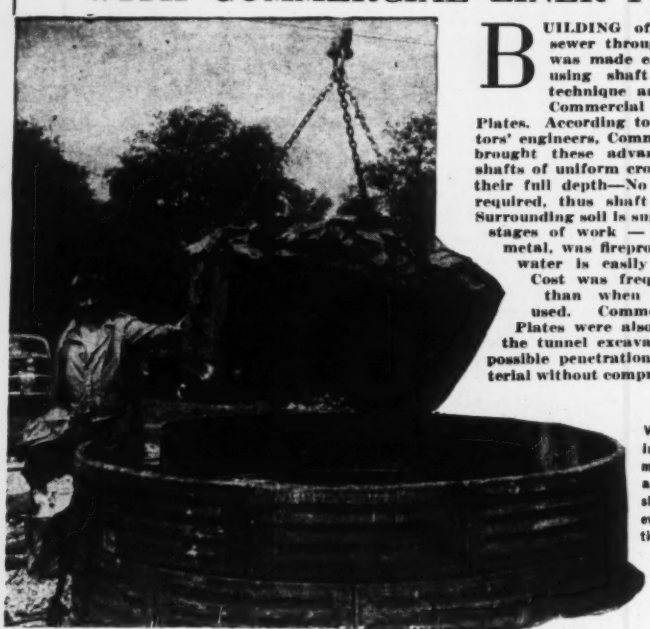
GEORGE HAISS MFG. CO., INC., 140th Street & Rider Ave., New York 51, N. Y.

CONTRACTOR SOLVES PROBLEMS . . . SAVES TIME AND EXPENSE WITH COMMERCIAL LINER PLATES



BUILDING of a mile-long sewer through sandy silt was made easier here by using shaft and tunnel technique and employing Commercial Steel Liner Plates. According to the contractors' engineers, Commercial Plates brought these advantages: Deep shafts of uniform cross section for their full depth—No bracing was required, thus shaft was clear—Surrounding soil is supported at all stages of work — Liner, being metal, was fireproof—Inflow of water is easily controlled—Cost was frequently lower than when timber was used. Commercial Liner Plates were also installed in the tunnel excavation, making possible penetration of wet material without compressed air.

Write for further information. Commercial Liner Plates are available in any shape or size for every ground condition.

The COMMERCIAL SHEARING & STAMPING CO. YOUNGSTOWN 1, OHIO

office in Washington. Prior to being called to active service, Mr. Harton served with the Tennessee Valley Authority for eight years.

H. E. Hedges, resident engineer of the Portland office of the United States Bureau of Public Roads, recently established headquarters at Pineville, Ore., to supervise construction of a new highway route, east of Pineville.

Galen Fiddick, recently assumed his new duties as resident engineer for the Iowa Highway Department at Decorah, Iowa.

Edgar A. Thomas, who had been assistant city engineer for East St. Louis, Ill., has been named executive director of the East St. Louis Department of Streets and Public Improvements.

Fritz Zapf, senior civil engineer for the city of Alameda, Calif., has been appointed city engineer and superintendent of streets for the city of Redondo Beach.

George M. Shepard, city engineer at St. Paul, Minn., has been appointed an urban highway consultant for the U. S. Department of Public Roads.

T. R. Lovell, superintendent of the sewage treatment plant at Marshalltown, Iowa, has resigned to accept a post as chief engineer for the Thorpe Well Co., of Des Moines, Iowa.

J. F. Salmon, of Toronto, Canada, has been named bridge engineer for the central region of the Canadian Railway.

Edward Clay O'Rear, of Frankfort, Ky., has become a staff engineer for the Kentucky State Public Service Commission.

Thomas Thomas, 79, has retired as engineer of the city waterworks at Decatur, Ill., after 39 years of service.

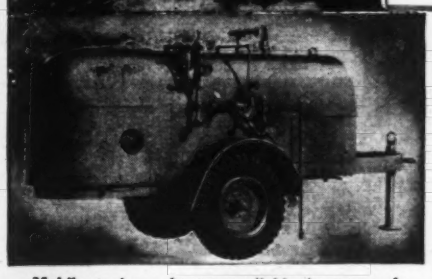
W. J. Crouse, of Frankfort, assistant director of the division of rural highways, has been promoted to district engineer of the Louisville highway district for the Kentucky State Highway Commission.

James F. Nolan, has become assistant city engineer of Decatur, Ill.

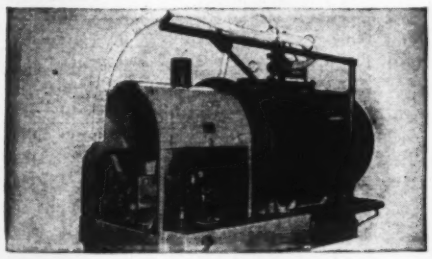
Col. George Gillette, Wilmington, N. C., district engineer, has been named acting director of the South Atlantic Division of the Corps of Engineers.

I. H. Lundgren has been appointed chief engineer of the Warren, Ohio district for the Republic Steel Corp.

Service records of owners prove the RELIABILITY OF CLEAVER-BROOKS Bituminous Heating Equipment



Mobile tank-car heater available in two and three tank-car sizes. Oil-fired with exclusive design four-pass flue travel; dry-coil steam condensate return under pressure—no water or heat loss.



Portable pumping booster. Heats by direct firing in one operation, loading directly to distributor, relay truck or returning to tank-car. Available in 2 sizes—truck mounting or 4 wheel trailer.

Truck mounted pumping booster in service of Oklahoma Bituminous Distributing Co., Ada, Okla.

★ Most of the pioneer models of tank-car heaters, built by Cleaver-Brooks sixteen years ago, are still in service.

★ There are more Cleaver-Brooks tank car heaters and bituminous boosters in service than all other makes of similar equipment combined.

★ Service records from hundreds of owners prove Cleaver-Brooks dependability and durability. Cleaver-Brooks equipment is usually assigned to the difficult jobs—the hardest jobs—because of its known capacity and reliability.

★ The design and construction of Cleaver-Brooks heating equipment is subject to constant check—to include every feature that contributes to the most effective performance and long service life.

★ Cleaver-Brooks heaters are the "finished" product of the pioneers and originators of tank-car heaters and bituminous boosters—built by specialists in the construction of portable and stationary steam generators.

On your next bituminous heating equipment purchase you can expect to get more value from Cleaver-Brooks—qualified by experience and facilities in this specialized field.

CLEAVER-BROOKS COMPANY, 5107 N. 33rd St., Milwaukee 9, Wisc.

Cleaver-Brooks

PIONEERS AND ORIGINATORS OF

TANK CAR HEATERS . . . BITUMINOUS BOOSTERS . . . AUTOMATIC STEAM-PLANTS

MR. CONTRACTOR

It is your responsibility to control the air content of the concrete.

Read the new "specs" on the amount of air that must be entrained, and then use Darex AEA as a gauge-water addition. You can meet the specifications and keep the control of the air content in your hands. It's the only way you can compensate for changes occurring in the field.

Darex AEA costs only a few cents per yard. It is safe, harmless. Comes ready to use. Darex Air Entraining Concretes save you time and labor because they are plastic, workable, reduce segregation and bleeding, speed up finishing, give durable concrete. — DEWEY AND ALMY CHEMICAL COMPANY, Cambridge 40, Massachusetts.

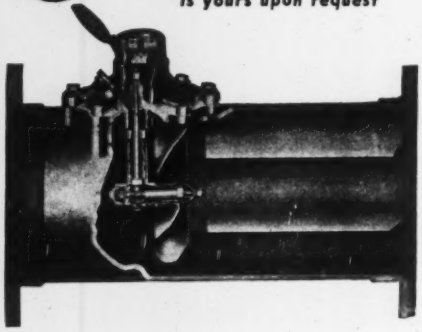
Use Darex AEA with Confidence

Measuring meters available

Simple metering devices for Darex AEA are available. Write for details.

SPARLING MAIN-LINE METERS

Bulletin No. 309 is yours upon request



- Consistent Accuracy
- Lowest Head Loss
- Easily Installed
- 27 Years' Experience behind each meter

SPARLING

Manufacturer of Water Measuring Equipment

LOS ANGELES CINCINNATI
CHICAGO BOSTON NEW YORK

James A. Lindsey, Jr., civil engineer graduate of the University of Minnesota, is now employed with Hitchcock & Estabrook, consulting engineers of Minneapolis, Minn.

Eleven employees of the Texas highway department who have served more than 25 years recently received special awards from the department. They included **W. H. Garrett, Herbert Schroeter, V. O. Ellis, C. P. Hunter, S. J. Treadaway, H. P. Krause, J. V. Gilstrap, J. E. Hughes, Arthur Free, J. D. Dickey,** and **W. G. Kinney.**

Herbert Moore, sanitary engineer of Milwaukee, Wis., having completed three years of service in the Sanitary Corps of the U. S. Army, has announced reopening of his office in the Pereles Building, Milwaukee. A civil engineer graduate of Cornell University, Mr. Moore served with the 7th Medical Laboratory and later with Headquarters, U. S. Air Forces, in Europe.

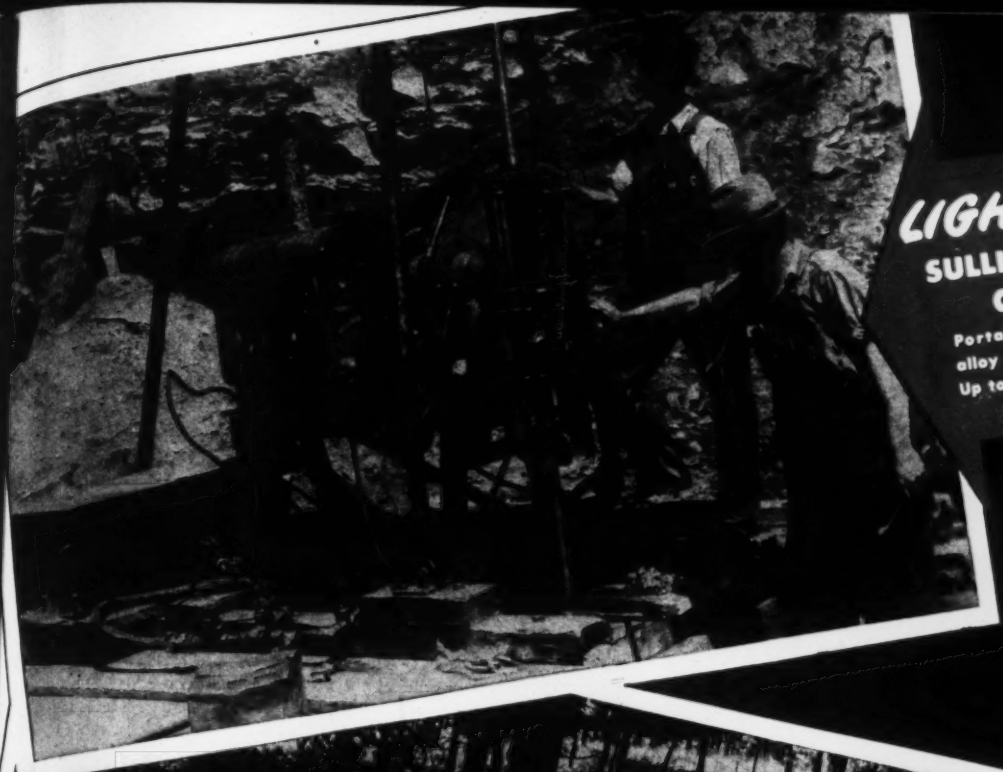
About District Engineers

Col. John O. Colonna, formerly engineer for the U. S. forces in Austria, has been appointed the U. S. district engineer for the Milwaukee, Wis. area.

Col. Craig Smyser, has been appointed to the post of district engineer, in Denver, succeeding **Col. James V. Johnston,** the Army Chief of Engineers announced. Colonel Smyser, a Denver, Colo., resident, recently returned from the China-Burma-India war theater where he served on the staff of Lord Louis Mountbatten. He was graduated from West Point in 1934 to be assigned to work on the construction of Fort Peck Dam. He later served with the late Gen. Simon Bolivar Buckner in Alaska. Colonel Johnston will be released from active duty to return to his former position with the Gulf, Mobile & Ohio Railroad at Mobile, Ala.

Evans H. Hunt, assistant executive officer of the division office of the Corps of Engineers in St. Louis, Mo., has been awarded the Meritorious Civilian Service Emblem. He has been a civilian employe of the War Department for 34 years and served as an Army Officer overseas in World War I.

E. H. Leutje, civil engineer graduate of Iowa State College, 1930, is now resident engineer on the construction of flood control works for the U. S. Engineer Department, to protect Williamsport and South Williamsport, Pa., against floods of the Susquehanna River, the work is estimated to cost about $10,000,000.



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Elections and Activities

John J. Ledbetter of Dallas is the first executive secretary of the Texas Society of Professional Engineers.

The Ft. Worth Chapter of American Society of Civil Engineers has installed these new officers: Henry Rockwood, regional engineer for the U. S. Weather Bureau, president: E. L. Ferguson, regional engineer with FWA, vice-president; and J. R. Hendrick, design engineer with city water department, secretary.

Officers of the newly-formed Lancaster-York chapter of the Pennsylvania Society of Professional Engineers are: Thomas A. Monk, Jr., president; H. C. Kern, vice-president; K. E. Rochhold, secretary; and Robert Mayo, treasurer; Frank H. Shaw, state director.

Officers of the new Anthracite chapter of the Pennsylvania Society of Professional Engineers at Harrisburg are: President, Paul A. White; secretary, Oscar W. Shimer; treasurer, H. L. Burmeister; and State director, L. D. Lamont.

E. A. Bernbrock has been elected president of the Illinois Association of Sanitary Districts and Authorities. Other officers: George T. Cresse, first vice-president; J. Carl Hart, second vice-president; and John R. Longley, secretary-treasurer.

Leo N. Newman, vice president and secretary of the Josam Mfg. Co., was elected president of the Ohio Chapter of the American Society of Sanitary Engineering at a recent meeting at Cleveland. Other officers elected included: Horace Wetzel, first vice president; Ralph W. Oliphant, second vice president; James Murray, third vice president, and Carl J. Bash, secretary and treasurer.

Howard J. Smith, of Phoenix, has been appointed executive secretary of the newly organized Central Arizona Project Association—a group organized to assist in obtaining the Bridge Canyon project to provide water for the state.

Maj. Gen. Leif J. Sverdrup, of the consulting engineering firm of Sverdrup & Parcel, St. Louis, Mo., was elected president of the joint council of the Associated Engineering Societies of St. Louis at the recent 32nd annual meeting of the council. Walter Siegerist was elected vice-president and L. E. Carlson secretary-treasurer.

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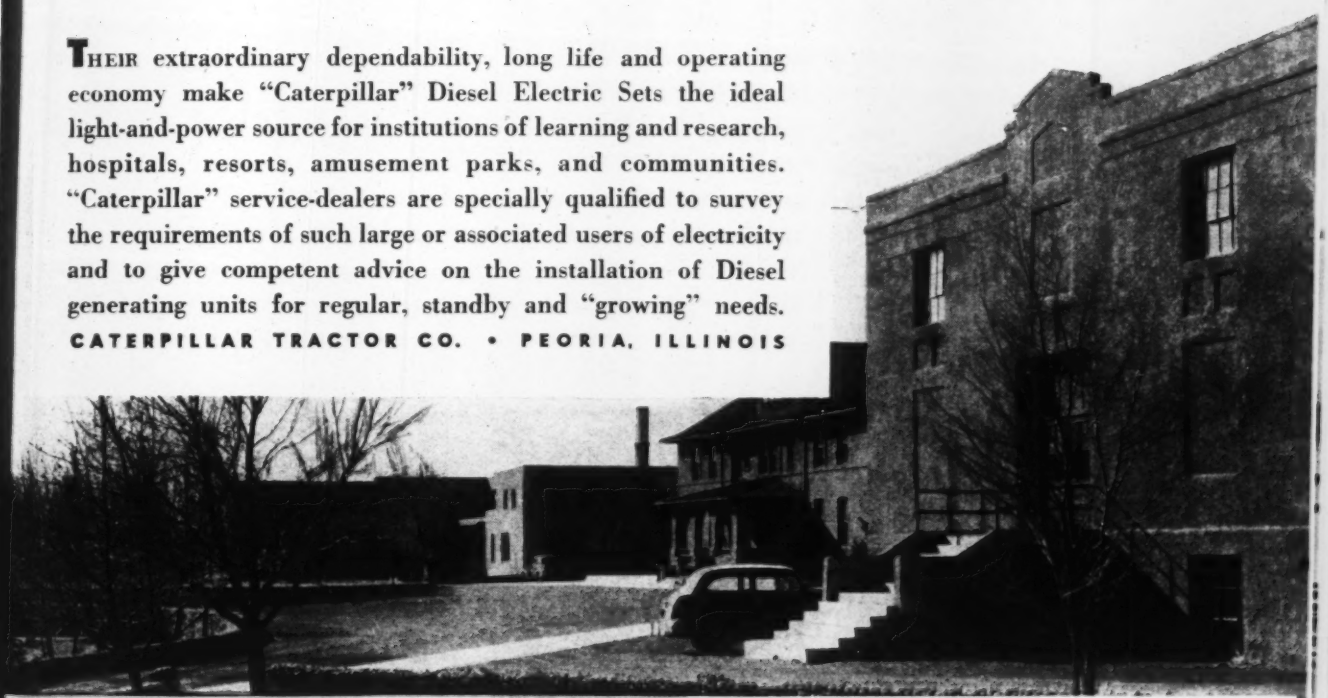

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Manufacturers' Activities

W. E. DIFFORD, managing director of Douglas Fir Plywood Association for the past eight years left the trade-promotion organization July 1, it is announced by E. W. Daniels, president of Harbor Plywood Corp. or Hoquiam, Wash. Harrison Clark of Tacoma, assistant to Mr. Difford, has been named acting managing director.

KENNETH F. KICHMAN has been appointed district manager of the Beckwith Machinery Co.'s Harrisburg office. He has been active in the Harrisburg territory for some time and has worked in the company's parts department and served as parts department manager. In 1934 he was associated with Stouffer Tractor and Equipment Co. and the Barnard Tractor and Equipment Co.

ON JULY 1, 1946 the J. M. & L. A. Osborn Co., Cleveland, Ohio, one of the oldest sheet metal manufacturers in the country changed its name to Milcor Steel Co. The Osborn Co. was purchased by Milcor in December, 1944.

L. O. MCLEAN has been appointed sales manager of The General Excavator Co., Marion, Ohio, manufacturer of shovels, cranes, draglines and other material handling equipment. He first associated with this company in 1920 and succeeds Don B. Smith, who has resigned. Mr. McLean has had extensive experience in the construction and construction equipment industry and founded the McLean Construction Co. in Pittsburgh.

NEW OFFICERS of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, are: Herbert T. Florence, president; A. C. Garnett, vice-president and treasurer; W. G. Wehr, secretary; and W. D. Vanderbilt, assistant secretary.

DRAVO CORP. has made changes in its top executive personnel and the list is now as follows: J. D. Berg, chief executive officer; W. K. Fitch, chairman of the board of directors; Carl B. Jansen, president; and Robert W. Marvin, vice-president. W. E. Clark was elected a director. Walter P. Berg is general manager of the machinery division.

J. B. TROTMAN, general sales manager of the Blackmer Pump Co., Grand Rapids, Mich., for the last six years, is head of the newly-organized industrial pump division of Bowser, Inc., with headquarters in Fort Wayne, Ind.

Manufacturers' Publications

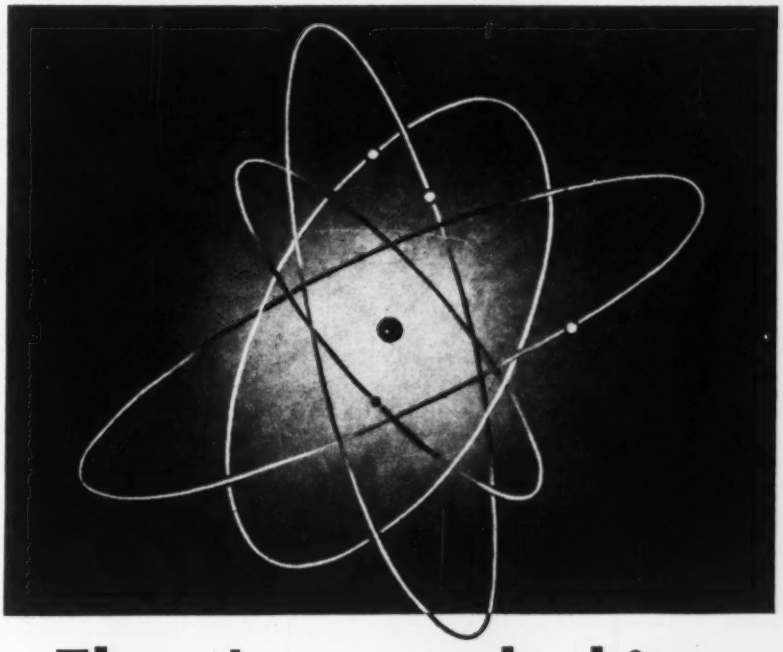
Belt Conveyor Idlers—(26-p. bulletin) Includes photographs, tables, charts, diagrams and cutaway views. First section is devoted to proper selection of idlers, followed by description of complete line of standard idlers and section on special application units. Impact-cushioning troughing idler and rubber-covered spiral return idler are newest Rex units described.—*Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, Wis.*

Chemicals and Industrial Explosives—(44-p. booklet) Indexes products according to various industries in which they are used and also according to chemical families. Chemicals discussed include cellulose, rosin, synthetic resins, terpene solvents and chemicals, chlorinated products, explosives, blasting supplies and sporting powders and special products.—*Hercules Powder Co., Wilmington, Del.*

Electrodes—(16-p. bulletin) Describes new type of electrode designed to prevent underbead cracking in welding steels. It gives complete information on Type HTS, lime-ferritic electrode. In addition to descriptive matter, tables give full data on physical properties and chemical analysis of Type HTS deposit in all standard electrode sizes. Also included is information on effect of stress relieving and comparative deposition characteristics of this and other mild steel electrodes. Various actual applications are discussed, along with advantages from its use.—*Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.*

Joint Cover—(4-p. folder) Announces availability of Perfection joint covers, expanding metal protection for mortar joints in masonry. Method of setting covers is illustrated.—*Dusing & Hunt, Inc.*, 1927 *Elmwood Ave., Buffalo 7, N. Y.*

Trencher—(8-p. bulletin) Covers Model 120, boom-type trencher which digs trench from 18 to 48 in. wide and up to 11½ ft. deep. It features tubular bucket line boom that may be moved from left to right of center for cutting close to obstructions. Boom has unique telescoping arrangement that provides ready adjustment for cutting 7, 9 or 11½-ft. depths. Complete specifications are given and construction details shown. —*Buckeye Traction Ditcher Co., Findlay, Ohio.*



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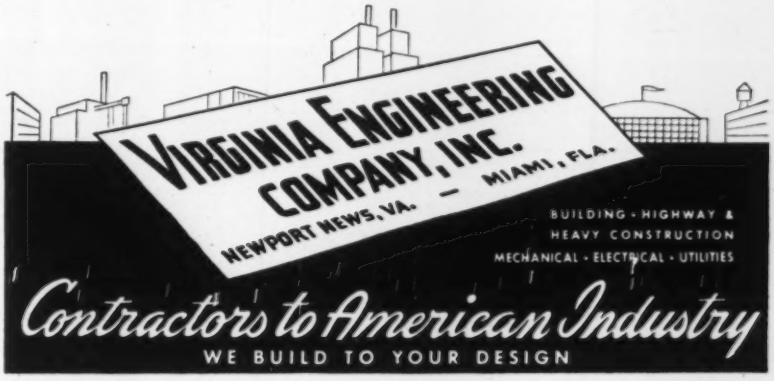
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WATER SUPPLY

PROPOSED WORK

Calif., Martinez — City, City Hall, water treatment and pump. plants. **$396,000.** A. Kempkey, Balboa Bldg., San Francisco, and Charles Gilman Hyde, 2599 Buena Vista Way, Berkeley, consult. engrs. CD 11/30/45—ENR 12/13/45.

Ga., Cairo—City, WW sys. **$370,000.** Wiedeman & Singelton, C & S Bank Bldg., Atlanta, consult. engrs. CD 7/17.

Ill., Centralia—City, c/o City Clk., plans under way water distribution lines, filter plant with auxiliaries etc. **$150,000.** Warren & Van Praag, Inc., Standard Office Bldg., Decatur, consult. engrs.

Ill., Moline—City, Mrs. A. N. Brissman, clk, water supply imprvs., rehabilitation pump plant. **$200,000.**

Kan., Iola—City, T. O. Waugh, mayor, City Hall, plans under way, water treament plant, imprvs., $123,763. Financing not provided. Brink & Dunwoody, consult engrs.

★**Kan., Piper**—City, c/o Clerk, City Hall, water sys., **$500,000.** E. W. McLaughlin, 1805 Freeman St., Kansas City, consult. engr.

Mont., Scobey—City, City Hall, addnl. water supply. **$25,000.** Corwin & Co., Inc., Medical Arts Bldg., Great Falls, consult. engr.

Nev., Lovelock—City, J. R. Gill, mayor, City Hall, plans imprvs. water supply and distribution sys. incl. installation of a 1,000,000 gal. cap. storage reservoir 500 ft. deep 12 in. cased well and extending the present well to a depth 500 ft. **$75,400.**

N. C., — City, surface water supply, storage, transmission line, **$134,063.**

★**O., Toledo** — Comrs. Lucas Co., Courthouse, reinforcing approx. 7 mi. line water with 12- to 24-in. c.i. pipe, Nebraska, W. Bancroft and Dorr Sts., **$600,000;** Waterline Proj. 264, Westwood Gardens, 17,430 ft. 6 and 8 in. c.i. pipe, **$75,000;** Proj. 293, Fern Dr., 550 ft. 6 in. c.i. pipe, **$2,000;** Proj. 285, Lorraine Pl. and Oak Grove Addn., 3,160 ft. 6 in. c.i. pipe, **$12,000;** Proj. 290, Secord Rd., 2,640 ft. 8 in. c.i. pipe, **$12,000;** Proj. 280, Fleet St., 2,000 ft. 6 in. pipe, **$10,000;** Proj. 281, Oak Grove Gardens, 4,490 ft. 6 and 8 in. c.i. pipe, **$25,000.** S. C. McKee, Courthouse, co. sanitary engr.

Pa., Bradford—City, plans under way reservoir **$229,663;** water line exten. **$113,500.** Financing provided.

Pa., East Hempfield (Lancaster P. O.)—East Hempfield Twp. water supply sys. **$107,570.** Financing provided.

Pa., McKeesport — Crescent Twp., plans under way water sys., Crescent Twp. **$143,800.**

Pa., New Holland—New Holland Boro, plans under way reservoir **$103,000.** Financing provided.

Pa., Phila.—City Dpt. P. Wks., City Hall Annex, plans under way, Booster Pump. station, Lardner and Oakley Sts., **$106,000.** E. Taylor, Water Bureau ch. engr. Financing provided.

★**Pa., Phila.**—City Dpt. P. Wks., City Hall Annex, high pressure station, 52 St., **$152,000;** revision of piping, installing automatic post-chlorination and corrosion control, **$97,000;** rapid sand filters, **$200,000;** new rapid sand plant, **$2,520,000,** at Belmont Plant; carbon feeding equip., chlorine solution line, equip. and piping for ammonia application, **$22,500;** rehabilitating mechanical filter beds, **$170,000;** new dry feed equip., **$50,000;** new pretreatment plant, **$2,686,000;** reconstructing mechanical filters, **$1,765,000,** at Queen Lane Plant; carbon feeding equip., addnl. affluent conduit and automatic chlorinators, **$455,000,** at Torresdale Plant. Financing provided. Morris Knowles, Inc., Park Bldg., Pittsburgh, consult. engr., E. J. Taylor, ch. engr. CD 11/24/44—ENR 12/14/44.

★**Pa., Phila.** — City Dpt. P. Wks., City Hall Annex plans under way, carbon pre-treatment plant, Ozone and Belmont Plants, **$753,000.** Financing provided. Morris Knowles, Inc., Park Bldg., Pittsburgh, consult. engrs. E. Taylor, Water bureau ch. engr.

Tex., Plainview — City, plans completed water works sys. extns. and imprvs. **$115,000.** Financing provided. W. J. & Ben Williams, P. O. Box 1272, consult. engrs.

Utah, Riverdale—Town, c/o R. G. Harding, Utah Sav. & Trust Bldg., Salt Lake City, imprv. water sys. also sanitary sewers. **$180,000.** R. G. Harding, Utah Savings & Trust Bldg., Salt Lake City, consult. engr. CD 7/24—ENR 8/8.

Wash., Tacoma—City, c. i. watermains, between S. 48 and 64 Sts., Pacific Ave. to I Sts., **$130,000.** Financing provided. W. A. Kunigk, water supt.

Wis., Cudahy—City, water filteration plant, elevated water tank, **$250,000-$300,000.** Consoer Townsend & Associates, 211 W. Wacker Dr., Chicago, Ill., consult. engrs.

Alta., Vermillion—Town, water sys. about **$230,000.**

B. C., Smithers—Town, water sys. to be taken from Bulkley River. About **$160,000.**

B. C., Victoria—City, 3,200 ft. of 20 in. steel pipe, as feeder main, other imprvs. to distribution sys. About **$150,000.**

B. C., West Vancouver—Town, renewal 11 mi. of wood pipe with cast iron pipe, 6-8 in. About **$450,000.** CD 3/16/45—ENR 4/5/45.

N. B., Moncton—City, duplicate water mains. About **$200,000.**

Ont., Delhi—Municipality, WW sys. **$200,000.** W. H. Fairchild, Delhi, engr. CD 8/1.

Ont., Ridgeway—Town, further exten. to water mains. About **$100,000.**

Que., Three Rivers—Municipality, watermains, **$100,000.** P. E. Dufresne, City Hall, engr.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Ark., Russellville — J. A. Baker, mayor, sewerage sys. **$387,000.** Dickinson & White, 115 N. Spring St., Little Rock, consult. engr.

Calif., Fillmore — City, City Hall, plans 10% completed, 59,000 lin. ft. vitr. clay, sanitary sewer collection sys., and treatment plant. **$257,000.** Donald R. Warren, 500 S. Figueroa St., Los Angeles, consult. engr.

Calif., Hemet — City, City Hall, plans 10% completed, sanitary sewer collection lines and treatment plant. **$125,700.** Bulot & Dondro, 9538 Brighton Way, Beverly Hills, consult. engrs.

Calif., Larkspur — City, City Hall, plans under way, outfall sewer and pump. plant, $110,750. J. Oglesby, city engr.

★**Calif., San Rafael** — Southern Marin Sanitation Dist., San Rafael, sewage treatment plant and sewer lines for San Rafael and outlying area. **$1,000,000.** Harry N. Jenks, 345 Madrono Ave., Palo Alto, consult. engr.

Ga., Adel—City, sanitary sewerage sys. imprvs. **$100,000.** Smith & Gillespie, 221 W. Adams St., Jacksonville, Fla., consult. engrs. CD 7/17.

Ga., Cochran—City, sanitary sewerage sys. extens. **$195,000.** Smith & Gillespie, 221 W. Adams St., Jacksonville, Fla., consult. engrs. CD 12/15/44—ENR 12/28/44.

Ga., Dawson—City, sanitary sewerage sys., disposal plant. **$258,000.** F. M. Daves, 774 Spring St., N. W., Atlanta, consult. engr. CD 7/17.

Ga., Fitzgerald—City, sewerage disposal plant. **$220,000.** Wiedeman & Singleton, C & S National Bank Bldg., Atlanta, consult. engrs. CD 7/17.

Ga., Madison—City, sanitary sewerage sys. extens. **$110,000.** J. J. Harte Co., Forsyth Bldg., Atlanta, consult. engrs. CD 7/17.

Ga., Metter—City, sanitary sewerage sys. **$120,000.** J. B. McCrary, Engrg. Co., 22 Marietta St. Bldg., Atlanta, consult. engrs. CD 7/17.

Ill., Alorton—Village, c/o Village Bd. Trustees, Alorton, sewage disposal plant with auxiliaries, appurtenances, sewerage sys. Approx. **$311,000.** James G. Cooney, First National Bank Bldg., Belleville, engr. CD 7/19.

★**Ind., New Albany**—Bd. P. Wks., J. G. Ferrell, clk., City Hall, sewage treatment plant and incinerator. **$860,000.**

Ia., Spencer—City, M. M. Moulton, clk., City Hall, storm sewer, $450,320. Financing not provided. L. L. Schol & Assoc., Spencer, consult. engrs. CD 11/11/43—ENR 11/18/43.

Kan., Eureka—City, H. Brookover, mayor, City Hall, sewer outfall line and sewage plant, **$124,455.** E. T. Archer & Co., Railway Exchange, Kansas City, Mo., consult. engrs.

★**Mass., Chicopee** — City, P. Wks. Dpt., City Hall, plans under way interceptor sewer Chicopee River. **$635,000.** Financing not provided. Tighe & Bond, 189 High St., Holyoke, consult. engrs. CD 2/11—ENR 2/14.

★**Mass., Worcester**—City, J. H. Brooks, supt. sewers, Worcester, sewage disposal plant, treatment sys., **$2,000,000.** Hayden Harding & Buchanan, 662 Park Square Bldg., 31 St. James Ave., Boston, consult. engrs., E. Perry, city engr. CD 3/29—ENR 4/18.

Miss., Starkville—City, sanitary sewage collection sys. extens., addns., sewage treatment plant, $221,475.

Miss., Wiggins—City, sanitary sewerage sys., treatment facilities, **$108,000.**

Mo., Normandy—Normandy Sanitary Sewer Dst., J. Eugene Aucly, chmn. Bd. Trustees, 7431 Augusta Ave., Normandy, St. Louis, 21, plans sewers, lift stations, etc. **$238,000.** Russell & Axon, 6635 Delmar Blvd. University City, St. Louis, 5, consult. engrs.

Mo., Owensville—City, J. R. Fisher, mayor, plans sewer extensions and imprvs., etc. $104,298. Russell & Axon, 6635 Delmar Blvd. University City, St. Louis, 5, Mo., consult. engrs.

Ore., Princeville — City, City Hall sewerage sys. **$135,000.** Bonds voted. R. H. Corey, Corbett Bldg., Portland, consult engr. CD 7/1—ENR 7/25.

Ore., Sandy—City, City Hall, plans under way, sewerage sys., disposal plant. $52,000. $24,000 bonds voted. H. L. Gilbert, Spalding Bldg., Portland, consult. engr. CD 3/11—ENR 3/21.

Pa., Ambridge—Ambridge Boro Comn., Ambridge, sewage treatment plant. **$350,000.**

Pa., Ardmore—Lower Merion Twp., surveys sanitary sewers. **$100,000.** storm sewers **$170,000.**

Pa., Claysville—Claysville Boro Comn., Claysville, plans under way sanitary sewers. **$109,600.** Financing provided.

Pa., Erie—Talon, Inc., 939 W. 26 St., waste treatment plant. Wilbur Watson & Associates, 4614 Prospect Ave., Cleveland, O., engrs.

Pa., Erie — Millcreek Twp. Conn., Millcreek. Erie plans sewers, Millcreek Twp. **$261,000.**

Pa., Ford City—Ford City Comn., sewers. **$150,000.**

★**Pa., Frankstown (Pittsburgh P. O.)** — Penn. Twp. Bd. plans under way sanitary sewers. **$647,105.** Financing provided.

Pa., Hatfield—Hatfield Boro Council, Hatfield, plans under way, stormsewers, over $40,000, sanitary sewers, over **$50,000;** sewage disposal sys., over **$150,000.** Financing provided. Albright & Friel, Inc., 1520 Locust St., Phila., consult. engrs. CD 7/31.

Pa., Havertown—Havertown Twp. Comn., Havertown, plans under way municipal bldg. **$220,000.** Financing provided.

Pa., Hyndman—Boro, plans under way sewage disposal plant, approx. 24,000 lin. ft. 8 and 10 in. sewers. **$115,000.** CD 2/7/45—ENR 2/22/45.

Pa., Lorain—Lorain Boro. Comn., plans under way sanitary sewerage sys. **$165,625.** Financing provided.

★**Pa., Monongahela City**—City, sewage disposal plant. **$572,000.**

Pa., Oakmont (Pittsburgh P.O.)—Oakmont Boro Comn., sewers. **$100,000.** CD 10/31/45—ENR 11/29/45.

Tex., Fort Worth—Tarrant Co., Water Control & Imprv. Dst. 5, Courthouse Bldg., plans underway sewage treatment plant. **$125,233.** Financing provided. J. J. Rady, Insurance Bldg., engr.

★**Tex., Houston** — City, addnl. sanitary sewers, **$10,300,000;** addnl. incinerators, **$750,000;** addnl. storm sewers, **$12,500,000.** Bonds voted. G. L. Fugate, City Hall, engr. CD 6/27—ENR 7/11.

Tex., Plainview—City, plans completed sanitary sewer sys. ext. and imprvs. **$160,000.** Bonds voted. W. J. Ben Williams, P. O. Box 1272, Plainview consult. engrs.

Utah—Morgan—Town, c/o Mrs. Goldie Waldron, sanitary sewerage sys. **$123,400.** T. Adams, Utah Oil Bldg., Salt Lake City, consult. engr. CD 7/24—ENR 8/8.

Wash., Blaine—City, City Hall, plans under way disposal plant and sewerage sys. $150,000. Financing not provided. H. H. Sisler, 211 1 St., Kirkland, consult. engr.

B. C., Kelowna—Town, septic tanks, filter beds and sludge bed, repairing sewage plant and installing sewer connections to 100 wartime houses. **$101,695.**

Ont., Delhi—Municipality, sewerage sys. **$150,000.** W. H. Fairchild, Delhi, engr. CD 1/9—ENR 1/24.

Ont., Lakefield—Municipality, sewers, **$100,000.**

Sask., Yorkton—Town, 2 mi. 15-18 in. dia. pipe for relief sewers extens. About **$160,000.**

BRIDGES

PROPOSED WORK

★**Minnesota and Wisconsin**—Cities of Duluth, Minn. and Superior, Wis., C. D. Jeronimus, city clk., Duluth, Minn., high level bridge over St. Louis River between Duluth, Minn. and Superior, Wis., replacing interstate bridge. **$1,000,000.** C. E. Paine, 176 W. Adams St., Chicago, Ill., consult. engr.

Missouri — State Hy. Comn., Jefferson City, plans 90% completed, 30 ft. rein.-con. deck girder span bridge, concrete abutments on creosoted timber piling over Cold Water Creek, Rte. 115 TR, Proj. L 573 (4), Bridgeton East Rd., St. Louis Co. **$40,000.**

★**Neb., Decatur**—Burt County Bridge Comn., W. W. Small, chn., Blair, High bridge over Missouri River, near here. **$835,000.** Financing not provided. Kirkham Eng. Co., 1504 Dodge St., Omaha, consult. engr.